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ELECTRICAL REVIEW.

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CAB-SIGNALLING AT THE "MECHANICALS."

THE strongest impression brought away by one visitor to the discussion on "Cab-Signalling" at the Institution of Mechanical Engineers on the 18th of last month, was regret at what seemed to be the missing of a great opportunity in what is, undoubtedly, a crisis in the agitation for the provision of this method of signalling as an additional safeguard to railway operation; and candour forces the confession that this regret is justified by a perusal of the discussion as it appears in the pages of the *Journal*.

It is well known that the Board of Trade Inspectors recently recommended the Board of Trade to call upon the railway companies to carry out experiments with different systems of cab-signalling and automatic control, with a view to the selection of some such method suitable for universal adoption, and they added that they held "that some system of this description should be generally adopted in the future." It is also an open secret that a Committee is now considering the question of cab-signalling, together with other matters relating to railway operation.

This being the case, it might have been thought that the opportunity provided by the Institution of Mechanical Engineers would have been seized upon to thrash out the requirements of such systems. Five papers were presented, which were divided by one of the speakers into three divisions—two dealing with the subject theoretically, two dealing with practical systems, and one outside the scope of cab-signalling proper. Leaving the last paper out of account, the two theoretical papers may be dismissed by saying that they put forward nothing that was new or useful, and that they smelled more of the lamp than the footplate.

The papers described as practical dealt with two well-known systems—practically the only two designs which have any chance of adoption in this country—the differences between which are such as to indicate clearly two distinct schools. Moreover, this was the first occasion on which they had been put forward for consideration together. In the one system the designers seem to say: We will advise the driver of the position of the distant signal as he approaches it, and, further, if the signal is "on" we will apply the brake, to a certain extent, for him; we will not give him any further information whilst he is passing forward under the control of signals, and we will leave him in complete control of the indications he receives and of the brake after its automatic application. In the other system the designer seems to say: I will provide an automatic indication at some point before the driver reaches the distant signal, so that the driver may have his attention drawn to the fact that he is passing into a signal-controlled area, and give him an opportunity to look specially for the line signal if the conditions are such as to obscure it; at the distant I will further advise him of the positions (collectively) of the "stop" signals, and if they are "off," and their position is at a diverging junction, I will advise him which road, at the junction, is prepared. I will further arrange to keep control of the train throughout the signal-controlled area, so that he shall not be compelled to rely only upon his vision for further necessary indications after passing the distant. The apparatus shall be capable of giving a "line clear" indication between the distant and the home (combined with route indica-

tions), and emergency "danger" indications at that point and at all the "stop" signals. The apparatus shall show a danger indication when the engine is standing at a "stop" signal at danger and will be capable of receiving an "off" or a "calling-on" signal, as the case may be, at the home signal, and the latter indication shall continue to show its cautionary character after passing the home and up to the advance. Both the "off" and "calling-on" indications at the home will be combined with the appropriate route indications at a diverging junction. Lastly, I will give an "off" indication at the advance, and this indication shall be independent of any indications given behind the home signal. In the indications thus provided for there is not more than is now provided by accurate interpretation of the line signals.

Such, roughly, is a comparison of the results apparently aimed at under the two schools of thought, and which might have been expected to furnish the basis of a useful and instructive discussion which would have given a much needed lead to the Committee considering the subject with a view to legislation, or the issue of directive orders to the railway companies. Notwithstanding the memorandum to which reference has already been made, it is not likely that the Board of Trade will endorse the "selecting of some such method suitable for universal adoption." It is not likely that a selection of *any* system will be made. That would be for the Government to depart from all tradition, and English Governments are largely guided by precedent. To select a system for "universal adoption" is to discount all future invention, and the Government has wisely, in the past, left railways free to use whatever apparatus they please provided that they achieve the results demanded. This is shown conclusively by the many types of block telegraph apparatus in use. But a Government can say what results *must* be obtained; *how* the results are obtained is not material except to those who have to produce them. It was the opportunity to give the Government the considered reasonings of those who favoured one set of results or the other which was missed during the discussion.

Instead of a useful discussion on lines such as are here suggested, one found that individualism and the desire to *score* were rampant, and for the most part, the remarks made seemed to have no reference whatever to the effects desired for the guidance of the man on the footplate. Instead, there was a good deal of "fencing," a good deal of hesitation and a good deal of what is too difficult to describe in writing. One gentleman, whilst avowing himself an advocate of cab-signalling, was chiefly concerned to find objections to it. Another gentleman had been until recently of the opinion that only one system—the Great Western—was worth looking at, but whilst he now seemed deeply impressed with an inductive signalling method, his remarks did not disclose any whole-hearted belief in its entire effectiveness, and he went on to suggest that the present outdoor visual signals, "the very first thing devised," were really the best. Another thought the driver might be tempted improperly to use a switch, and on that point the author of one of the papers agreed with him, forgetting, apparently, that the same thing could be done with the apparatus he had described. The question was asked whether cab-signalling enabled trains to run to time in foggy weather (in a discussion dealing with safety of running). One of the authors described the "astonishment" at Paddington when several trains arrived to time during a fog, after the apparatus had been installed (the installation covered a distance of about 30 miles.) Another gentleman was anxious to tell the meeting that the railway with which he was connected was experimenting with audible cab-signals, and had actually been able to—dispense with a battery on the engine.

And so the discussion went on. Visual signals were inadmissible, because they took the attention of the driver off the line, which might be encumbered with platelayers' trolleys, cattle and other wild fowl which are so plainly visible to a driver at night time: cab-signalling would not prevent mistakes by signalmen: with the —— system the driver was not told that the signal was at danger when it was at "all right." Consider the criticism and answer in connection with the Great Western Co.'s system:—". . . . he noticed from the description of the apparatus that the *signal* was held up at '*line clear*' by the local battery situated on the engine. When the engine passed over the ramp, the circuit was broken and the *signal dropped* to danger. If the ramp were energised it picked up another current and received the 'line clear' signal *again*. It would be seen that the armature must be rather light, otherwise a very big battery was required or the armature would drop off through the shaking of the *train*. He concluded that the construction was of a rather *light character*. If that was so, the parts might stick either through corrosion or the presence of oil, or something similar. In that case, the switch would not give the danger signal. Another point was that, although brass pegs were probably provided to hold the armature off, there was such a thing as residual magnetism, and that might hold it up." (The italics are ours.) This is a criticism made after eight or nine years' use. The answer to this criticism is short. ". . . had referred to the power of the accumulator on the engine to *lift* the *heavy* armature. It was a 4-volt accumulator, and it would be seen from Plate 1 that the armature was, at any rate, robust enough to do its work." And, after all, the armature is replaced by hand.

Much more of the same character might be brought forward to show in what way so important a privilege as that given by the Institution of Mechanical Engineers for the discussion of a "live" subject has been misused, but enough is as good as more. Will any other institution provide a similar opportunity where the *essentials* may be thrashed out?

Lead.

The lead market has had a more subdued appearance during the last week or so owing to a certain extent to the lessened activity of buying on behalf of Russia, but also in some degree to a more accommodating attitude on the part of the larger producers in the United States. There is not the smallest doubt that the publication of the official returns of United States output took the market across the Atlantic completely by surprise, showing as they did an increase of about 100,000 tons in 1914 compared with 1913. Nothing like this had been expected by even the most bearishly-inclined people, and the issuing of the figures gave an almost immediate stimulus to the selling movement. Prices have not really weakened very much, but the tone has suffered to a minor extent. The future depends to an unusual degree upon the attitude to be taken up and maintained by the Americans.

If production in the United States is to be kept up to anything like the recent level, then certainly for a pretty long time to come the trade can do without the Mexican supply, the cutting off of which owing to revolution upon revolution has from time to time given rise to the greatest anxiety. Under all the conditions ruling now it is at least probable that we shall continue to receive a fairly liberal quantum of lead from the United States, while according to the indications we should be receiving more and more metal from Australia as the months roll by. Things at Broken Hill should tend to settle down by degrees, and the necessity of keeping labour employed cannot be overlooked. As it is, we can do without any lead from Mexico for the present, any deficiency being made up fully from other quarters.

An encouraging feature is the way in which demands have been kept up in spite of the war. A good deal of metal is naturally demanded for war purposes, but apart from this there is a steady demand from all branches of the consuming trades, and this shows no sign of relaxing. Indeed, the makers of oxide and carbonate have of late been talking in quite encouraging fashion of the rate at which they were meeting with inquiries, and these look like going on.

The activity in the shipbuilding yards is a highly important consideration in this respect, and the possibilities are worth considering. The consensus of opinion regarding the outlook is that there will not be any great alteration in current prices. These are quite high enough at present to encourage producers to keep a full working staff busy, while, on the other hand, lead, compared with some other

of the commercial metals, appears to stand at a comparatively attractive level.

The following statistics are interesting at this juncture, showing as they do the imports of lead into the United Kingdom over a series of years :—

1905	229,541 tons.	1910	218,936 tons.
1906	208 253 „	1911	213,704 „
1907	204,695 „	1912	205,375 „
1908	237,508 „	1913	204,136 „
1909	207,660 „	1914	224,194 „

Preferential Terms.

Mr. H. Faraday Proctor's statement regarding the use of arc lamps for photo-printing, published in our last issue, and Mr. Frank Broadbent's comment thereon in our "Correspondence" columns to-day, both touch upon a very interesting question, but both are open to criticism. In the first place, Mr. Proctor deals with the legality of charging for this class of lighting as if it were power. But we submit that the question of legality does not come in at all. So long as the same terms are offered to all consumers of the same class, no illegal preference is given. Even if electricity for photo-printing were sold at lighting rates, it would not follow in the least that luminous radiators would have to be classed as lighting also.

Again, Mr. Broadbent considers it to be generally understood that "electricity used for trade purposes," and not for illumination, should get preferential treatment. But no consumer, of whatever class, should get preferential treatment. Special rates may properly be given for specified classes of use—but not preferential rates.

Mr. Proctor says that the ultimate purpose for which energy is used must be taken into consideration; Mr. Broadbent traverses this statement, and in his last paragraph gets very near to the true root of the matter—namely, the fact that the whole thing depends upon whether the demand occurs during the "peak-load" period or not. Nothing else matters.

Whether the electrical energy is used for lighting, heating, motive power, photo-printing, charging batteries, or driving motor-generators is absolutely no concern of the supply engineer's; all that he need consider is whether the demand under consideration necessitates, or is likely to necessitate, an addition to his capital costs by increasing the maximum load upon his plant, and he should regulate his charges accordingly. Granted that it is impossible in practice to carry out this principle absolutely—just as it is impossible to achieve perfection in any pursuit whatever—the aim of the supply engineer is to approach the ideal as closely as is commercially and practically feasible.

Some day the peak will become of relatively little importance—progress is constantly tending in that direction, with the increased efficiency of lighting appliances and the multiplication of off-peak demands; and when that day comes an all-round flat rate will be in order. May it be soon!

Russia and German Firms.

The question whether Russia can dispense with the assistance of foreign firms is engaging the attention of the leading newspapers in Petrograd, with special reference to German optical glasses, aniline dyes, and electrical engineering work. According to a communication obviously made by a German to a Frankfort newspaper, electrical engineering was introduced into Russia by Teutonic firms, although the part played by Belgium and one United States company is naturally overlooked. But when the correspondent asserts that the Russian authorities have closed the electricity supply works in Petrograd, Moscow and Warsaw, and that these cities are almost enshrouded in darkness, he is certainly taxing the credulity of his readers, especially as the Swiss Ambassador had no such complaint to make when having an interview, almost simultaneously with the date of the communication, with the Russian Minister for Foreign Affairs in connection with the extensive Swiss holding of capital in the Russian Electric Lighting Co. of 1886, which owns the leading supply works in the three cities concerned. Not only so, but the general interests of the three towns would be opposed to the closing of the stations, which are merely to be, or have been, placed under compulsory administration, as in the case of the German electrical manufacturing works, unless the documents to be produced by the Swiss Minister prove conclusively that the majority control of the capital in question is now held by Swiss financiers and French capitalists, the latter of whom are said to have acquired their interests from German holders some time ago. The correspondent of the Frankfort newspaper proceeds to quote a Petrograd professor as having declared that the electrical manufactures now procured from Sweden by Russia are not of Swedish origin, but of German construction, and that their purchase consequently only serves to enrich the enemy which has hitherto exported to Russia electrical manufactures of the value of £2,000,000 per annum, and has received from Russia a further sum of £3,000,000 per annum as the earnings of supply works in Russia. The first-mentioned amount may be correct, but the latter appears to be an exaggeration, unless it also includes the income derived likewise by Belgian and French interests, and the earnings of the Teutonic manufacturing companies in Russia. At any rate, the fact that the Russians are discussing the situation so as to become, if possible, independent of Germany in the future, affords confirmation of our recent remarks on the subject, and it should assist in the development of business relations between Russia and her Allies.

Syndication Methods in Germany.

A recently issued report by Sir Francis Oppenheimer, H.M. Commercial Attaché in Germany, contains a store of information relative to the organisaton and methods adopted by German manufacturers in their quest for world trade. A study of this report, to which we shall refer more fully in a later issue, will indicate which of these methods might be emulated generally and, in particular, turned to advantage in our own electrical trade.

A striking picture is drawn of the height to which concentration of interests has attained. Not merely do we find a combination of manufacturers of certain finished articles gathering into the fold all the concerns who supply them with their partly-finished or raw products, but we also find producers of raw materials acquiring the factories which utilise them. It is admitted that the control of production and sales by this syndication method has prospered more in connection with unfinished products than in connection with finished products. Sir Francis Oppenheimer suggests that such elaborate concentration as obtains in Germany could not succeed save under a system of tariff protection for the home market. Surely, however, a sufficient measure of success has attended various combines—*e.g.*, salt, soap and chemicals—to warrant our engineering trades in trying more co-operative methods. In Germany syndication has made the home trade predominantly lucrative; it is true that the resultant over-production has forced the finding of export outlets even at poorly remunerative prices; but the fact remains that a big export trade has been secured. Without syndication it is doubtful whether preferential export rates could have been obtained from railways and shipping companies, and whether support for commerce could have been enlisted so freely from diplomatic and financial circles. Sir F. Oppenheimer mentions that a big Rhenish-Westphalian combination came to the assistance of the actual banks to which it had originally owed its own phenomenal rise. Such intimate relationship between manufacturers and financiers seems very far from fruition in this country.

Granted that there are various lines of electrical manufacture which can be profitably extended here now that Germany is otherwise occupied, little advantage will be gained by individual British concerns spending money on investigation, perhaps laying down fresh plant, and then engaging in as much price-cutting amongst themselves as used to take place between the nations. But if a joint investigation could be carried out, existing selling organisations utilised co-operatively, and the resulting orders allotted, according to their nature, to those manufacturers best laid out for executing them, then the venture would stand an excellent chance of developing profitably and permanently.

LABOUR PROBLEMS: PAST, PRESENT AND FUTURE.

As we have already stated in some of our comments on industrial questions as affected by the state of war, what we are accustomed to describe as Labour Problems are being considered in an entirely different atmosphere—indeed, some of them are problems no longer, they have automatically solved themselves under the stress of circumstances, and in presence of a noble spirit of patriotism. In all likelihood some of the old controversies and differences which, but a short time ago, loomed so largely in the industrial outlook, and seemed to employer and to social reformer alike matters of prime concern, will not be reproduced, at any rate in the near future and under similar conditions. Politicians all would be well advised to adopt the advice given to the Liberal Party by Lord Rosebery in a famous Chesterfield speech, and start again as far as practicable with a "clean slate." We are far from suggesting that all the old grievances are going to be swept away by this terrible war, but we do suggest that they may be relegated to a position of minor importance in presence of the subjects of far greater national consequence which must inevitably occupy all of our minds for many years to come, and that they will come nearer to a common-interest basis of settlement in presence of the more sympathetic and united spirit which is fairly generally prevalent in these days.

While it is perfectly true, however, that some matters are in a state of suspense, and will remain so, it must also be recognised that the war has itself, by its simultaneous demands upon Labour, calling men to arms, and upon industry, clamouring for material of all kinds from thousands of factories, brought certain problems of the familiar class very urgently before our minds, and has created a number of new ones of an engrossing character. The best illustration of this is to be found in the most interesting report which was recently issued by the Departmental Committee which, at the instigation of the Local Government Board, investigated the new and unprecedented question of what employment could be found for the Belgian refugees who had sought shelter in these islands. All the civilised world was placed under an everlasting debt of gratitude to our Belgian Allies for their heroic defence of their country in presence of overwhelming and barbarous forces. All that has been done, and all the gifts that have poured in, could not adequately meet the necessities of their terrible condition. To find money, food and shelter has occasioned much difficulty, calling for scheming and contriving, but all of this has been done in a large-hearted way, and, we believe, to the best of our ability, without infringing any of our formerly accepted internal policies. It is when we get down to the problem of giving employment to our distressed Allies that we are perhaps likely to encounter the greater difficulty, for the permanent interests of the workers of the United Kingdom must not be adversely affected by the measures taken to cope with a particular and temporary emergency. The State has called workers to the Colours, employers have made either them or their families generous allowances, other employés are required to take their places. Under what conditions and at what wage shall Belgian refugees be permitted to take these situations? Everybody will agree that it is a thing not to be thought of that workers now with the forces shall find when they return to resume their avocations that wages have been reduced or the conditions worsened, or that their places at the bench and so forth have been filled by others not of British nationality. With this necessity for affording Protection to British Labour prominently in view the Departmental Committee has considered the whole question of Belgian employment. Happily at the present time there is such a feverish activity at the majority of the factories that there should be little difficulty in absorbing all suitable classes of Belgian Labour available at the same rates of pay as British workers are receiving. It may happen at a later stage, when we lay ourselves out to deal with the requirements of specialised industries established to supersede German imports, that other considerations on this skilled labour question will have to enter into our deliberations, but now we have to deal with immediate needs and with immediately available Allied labour. We believe that wherever Belgians have been at work in English factories latterly, the same spirit of sympathy and co-operation observed in Flanders has been present—each Englishman recognises that he owes to some extent the present security of his own family and home to the kith and kin of those beside whom he works. Under such circumstances the British workman shows that at heart he is not such a bad fellow, and no one desires that old industrial disputes shall be reopened, if they can be avoided, because of the conditions consequent upon the present emergency.

As the President of the Local Government Board has appointed a Commission to put into execution the recommendations of the Departmental Committee, some reference to those recommendations is called for. It goes without saying that no fit and unmarried Belgian between the ages of 18 and 30 should be given employment, their Government having expressed the desire that they should render military service. The Committee lays down two main principles :—

(1) That no Belgian labour should be employed until every reasonable effort had been made to find British labour through the agency of the Labour Exchanges.

(2) That no Belgian should be employed at rates of wages lower, or on conditions less favourable, than those generally observed in the district.

The refugees have been classified in three main groups as to their occupations, the first comprising workers qualified to fill vacancies in industries in which a shortage of British labour exists, such as armament workers, glass-blowers, miners, motor mechanics, &c. It is believed that the majority of those in this group have already found employment, or will find little difficulty in so doing. For professional men, clerks, musicians, lawyers, &c., there are no openings, though for tillers of the soil and other workers in agriculture opportunities will be numerous in the coming months. In the case of qualified workers for whom there is no employment offering, it is proposed that they shall make clothes, furniture, and household goods to take back to Belgium when the invader has effectively been driven out and the land is at rest again. The Committee expresses the fear that in some instances refugees have been employed on unsatisfactory terms and conditions, which circumstance is not calculated to engender good relations with Trade Unions which have subscribed towards the Belgian relief measures. It is proposed that in all Government contracts it shall be made a condition that Belgian labour shall only be employed through the Labour Exchanges, and that a like principle shall be followed both by the railways and mining authorities of the United Kingdom.

Further, Government Inspectors are to impress upon employers the fact that the employment of Belgian refugees at rates of wages and under conditions other than those prevailing for British labour, is contrary to the Committee's regulations.

We believe that the Committee has handled a matter of great difficulty with considerable ability, showing full sympathy for our distressed Allies, and appropriate foresight in regard to British interests.

From various sources we learn of the shortage of general labour. The congestion at the docks in London is in part due to this circumstance, but early relief is very necessary, and it is a pity that we cannot commandeer the services of the loafer, carrying into practice the healthy principle that if a man will not labour, neither shall he eat—or drink. It is also deplorable that the Port of London Authority should have such poor facilities for transferring labour from point to point as it becomes available.

In the matter of skilled labour, however, the difficulty is far greater, and the necessities of the situation in engineering works engaged upon Government orders have, according to an article by the *Times* Sheffield correspondent, led the Amalgamated Society of Engineers, "perhaps the most exclusive among Trade Unions," to "relax its guard and permit untrained, or partially untrained, labour to be employed upon semi-skilled work." The writer states that "of 17,500 Trade Unionists engaged in the construction of steam engines, there are at present only 10 drawing out-of-work pay." We read in another contemporary that

an official report shows that employment could be found for over 15,000 workers of various grades in the engineering industry of the country. It is most gratifying to read of the co-operative spirit that prevails between the A.S.E. and the Federation of Engineering Trades Employers in face of our common danger, and if in more peaceful times they can only be brought to regard labour disaffection as an enemy common to both sides, which should be tackled in a reasonable spirit, the hopes for the future of engineering industry and employment may be allowed to run high. Conferences have been held between the A.S.E. and the Employers' Federation, under which the agreement between them relating to unskilled labour shall be waived, in order to assist in the speedy execution of Government contracts for war material. The men have stipulated that several conditions shall attach to the use of unskilled labour for semi-skilled work, and they demand that wages proportionate to the work shall be paid, and that the arrangement shall end when the pressure ceases, their intention being to adopt every means in their power to preserve the province of the skilled man. We believe that the reasonableness of these stipulations will be conceded by the employers, and though perhaps the spirit of the old Trade Union Adam seems to show itself just a little bit, this is no more than is to be expected. Nobody will desire labour, especially skilled labour, which is rendering such magnificent service to the country at this time of crisis, to be placed at a disadvantage after the war. But if there is partly skilled labour available, it would appear ridiculous for requirements to be delayed because Unionists, in the interests of their *confrères*, imposed anti-national restrictions.

We cannot but deplore the trouble that has broken out among the miners of West Yorkshire at a time when their number is seriously depleted by the war, and when the textile factories are utilising fuel and power practically continuously. The peacemakers are at work, and we wish them speedy success. Without attempting to enter into the details of this latest development of minimum-wage controversy, we hope that both sides will fully recognise that the times are not normal, and that national needs demand concessions or compromise, so that peace at home may remain unbroken, allowing everybody to continue to help the Allies in their struggle with the enemy.

The whole question of labour will probably take on an altogether new aspect after the war is finished. In some respects the position of Labour may be strengthened, but we believe also that lessons have been learned by the rank-and-file. We do not want "cheap" labour in England, but somehow the cost of production has got to be lessened in respect of many manufactures by the time when German competition resumes. In absence of information as to when that may be; not knowing how many more men may yet have to be called away from their accustomed occupations; with some uncertainty as to the outlook for industry and trade, and with an almost certain depletion of the resources of skilled labour now in uniform, one can only hint at the prospect of the approach of new problems of labour in place of the old.

RUSSIAN ELECTRICAL AFFAIRS: GERMAN INFLUENCE IN THE PAST.

WE learn from a Petrograd paper that at a recent meeting of electrical engineers held in the Electrotechnical Institute of Alexander III, a discussion took place in the course of which M. Dmitrieff spoke at length on the foreign element in Russia's electrical industries. He said that Russia had a total of 137 central stations. Of these 80 belonged to municipalities and served 5,000,000 citizens, and 57 were concessions and served 9,488,000 citizens; that was to say, that although the concession stations were so many less than the municipal stations they served twice the number of citizens. The concessionaires had become the rulers of the most industrial and most densely-populated districts. The district stations in Russia controlled great industrial areas. For example, the 1886 Electrical Co., with its station at Moscow, controlled the Bogorod industrial region; with its Petrograd station it controlled the Petrograd district, and with the Lodz station the town of Lodz. The speaker pointed out the industrial, economic, and even political dangers of such control, and advocated co-operation as the proper basis for such enterprises, particularly on behalf of the groups of small capitalists who cannot afford to install independent plants for their separate use.

M. A. A. Kuznetzoff, referring to the importation of electrical materials from abroad, said that for some weeks after the outbreak of the war there was a great shortage of small electrical goods, whilst large goods could not be had at all. Stations the construction of which had been begun remained without machines. Only a few parts were to be had; the remainder were to be found somewhere, say Nurnberg, &c. All had become dearer in price. It had become necessary to apply to England and Sweden for what must be had. It appeared that Sweden, taking advantage of the products of German industry, had established, after two months of the war, a large electrotechnical industry. On a detailed and a careful examination of the goods imported from Sweden, judged by their type and construction, they are all from Germany, only without German marks. Thus, complained the speaker, "we are supporting Germany with our money." Two-thirds or three-quarters of the total importations must be ascribed to Germany.

All imported goods may be divided into three groups:—(1) Goods the importation of which fluctuates for various reasons, *e.g.*, wire. (2) Goods that have to stand a fair protective duty, or that are protected by the telegraphs or telephones; the importation of such goods into Russia is small. (3) Goods the importation of which into Russia is continuously growing, *e.g.*, electric lamps.

In the main, the production of electrical goods has been concentrated in large specialised factories. These are the following: The Russian General Electrical Co., original capital 12,000,000 roubles; the Russian Electrical Factories Co., Siemens & Halske, 5,600,000 roubles; Russian-Siemens-Schuckert, 15,000,000 roubles; the United Cable Factories, 6,000,000 roubles; the Siemens Polish Factories, 1,000,000 roubles; the Volta Co., 1,050,000 roubles.

Respecting the Tudor and the Dynamo Companies, reliable particulars of their original capital are not available. The Russian A.E.G. is no more than a branch of the corresponding house in Berlin. The chief office is in Petrograd, and the factories are in Riga. There are branches all over Russia; but they are governed by orders from Berlin. The chief shareholders in this company are Germans as can be seen from the minutes of the general meeting of shareholders held on May 7th-20th, 1914. This showed that the largest were the Allgemeine Electricitäts Gesellschaft, the Bank für Handel und Industrie, and representatives of various other Berlin banking houses.

The speaker proceeded to show by specific references that Siemens & Halske and the Siemens-Schuckert Companies likewise derived all their financial and controlling strength from Germany. After these detailed references to the principal Russian electrical concerns, he went on to say that the measures to be taken in the struggle with the Germans were as follows:—(1) To cease giving concessions to foreigners in Russia; (2) orders by the Government and public associations should be executed in Russia by Russian workmen and with Russian material—it is well known that in Russia the machines are only assembled; (3) the imposition of sufficiently high Customs dues; (4) the granting of credit by the Russian Imperial Bank to electrical concerns; (5) restriction of patent rights held by German subjects in Russia. The speaker concluded with these words:—"Our electrical power is abundant. *We have served German capital long enough. We must now serve ourselves.*"

M. P. M. Avaieff having spoken in a similar way, observed that the following electrochemical and metallurgical products were made in Russia in 1913. Electrolytic copper, 1,300,000 poods, value 18,200,000 roubles; electro-steel, 250,000 poods, value 625,000 roubles; aluminium, 80,000 poods, value 1,600,000 roubles; chlorate of potash, 150,000 poods, value 1,200,000 roubles; nitric acid, 3,500,000 poods, value 6,000,000 roubles; calcium carbide, 90,000 poods, value 400,000 roubles; electric accumulators, 210,000 poods, value 1,700,000 roubles. The capital

invested in the electrochemical industry yields up to 100 per cent. net profit. Unfortunately, it is nearly all foreign —German.

From the discussion that followed, it would seem that the capital in Russia in the savings banks, and what is used in the organisation of small credits, is practically all under the control of banks that receive their orders from Germany. Hitherto it has been impossible for an independent electrical industry to grow up in Russia, for *the Germans used large capital in order to snuff out any such efforts!*

ELECTRIC LIGHTING AUTHORITIES AND THE LAW OF RATING.

[FROM OUR LEGAL CONTRIBUTOR.]

Most of our readers will have received ere now a copy of a species of summons requiring such of them as be ratepayers to supply certain particulars to the overseers of the poor. This is a document which is served upon metropolitan ratepayers once in every five years, and it is one which should receive very careful attention.

To ascertain the rateable value of an ordinary dwelling-house is a comparatively simple matter. The overseers in one of the metropolitan boroughs make the following statement :—

"It may be mentioned for your information that the Council's Valuation Committee are required, in making the New Valuation List, to fix the gross value of all properties in the borough at an amount corresponding to the annual rent which the tenant might reasonably be expected, taking one year with another, to pay for the premises, if the same were let on an annual tenancy, and the landlord undertook to bear the cost of repairs."

When, however, we come to consider a highly complicated piece of property like an electric lighting undertaking, the ascertainment of the hypothetical rent is by no means a simple matter. Those who pay rates may be prejudiced either (1) by a rise in rates, or (2) by a rise in rateable value. As the corporate body has no say in the election of guardians who control the rates, its one means of protecting itself against anything in the nature of extortion is to prevent an exaggerated valuation. In these circumstances, it may be found useful if we discuss some of the principles upon which the property of electric lighting companies is rated, with a view to enabling interested persons to ascertain whether, in the light of events during the last five years, their valuation is likely to go up or down.

The law of rating is by no means simple. This is partly due to the fact that Parliament does not define rateable value, and has never attempted to do so. All the Legislature has ever done is to prescribe the means by which rateable value may be estimated. Seeing that the last Act dealing with the subject was passed so long ago as 1862, it is not surprising that it contains no reference to electricity or electric lighting undertakings.

We must, indeed, go back to first principles in order to ascertain the law of rating. The Parochial Assessments Act, 1836, provides that a rate must be "made upon an estimate of the net annual value of the several hereditaments rated thereunto ; that is to say, of the rent at which the same might reasonably be expected to let from year to year, free of all usual tenants' rates and taxes . . . if any, and deducting therefrom the probable average annual cost of the repairs, insurance and other expenses, if any, necessary to maintain them in a state to command such rent."

As such a person as an actual "tenant" of an electric lighting undertaking is a creature unknown, it has long been the practice, in rating gas companies and similar undertakings, to have regard to the profits which such a concern would bring in. Three leading principles of law are as follows :—

(*a*) In valuing the works, pipes, &c., of an electric lighting company for the purposes of rating, the profits earned by the company are taken into account.

(*b*) The exercise of the right to lay down wires and send electricity through them, amounts to an occupation in law, so as to be rateable.

(*c*) If the electric lighting works belong to a municipal corporation or other local authority, that body is rateable, although the profits earned are devoted to public purposes.

Let us now examine the method by which the rating authorities endeavour to ascertain the hypothetical rent.

The first step is to ascertain the net receipts. This is done by taking the receipts of the company from every source, and subtracting therefrom the ordinary working expenses (other than the cost of repairs, insurance, &c., which come in later on). Having ascertained the net receipts, it is necessary to inquire how much of them a tenant will be willing to pay as rent to a hypothetical landlord. He would not, of course, pay the whole receipts as rent, as he would not then have any incentive to embark on the undertaking. There must be a deduction for "tenant's profit," sometimes called "tenant's share." It is worked out as a percentage on the tenant's capital. The tenant's capital is the value of his loose stock-in-trade, and a sufficient capital sum to enable him to provide for working expenses. It would not, of course, include the value of the boilers, engines, dynamos or other fixed machinery at the central station, but it would include the meters on consumers' premises, and all the loose tools, &c. A percentage is then taken on the tenant's capital, and considerable difficulty is often experienced in deciding what this should be. At the London Quarter Sessions the usual practice in rating the property of a gas company is to take 5 per cent. for interest, 10 per cent. for trade profits, and 2½ per cent. for risks and casualties, making 17½ per cent. in all.

Having deducted the tenant's profit, we arrive at the gross value of the undertaking. According to the rule laid down in the Statute (*supra*), the cost of repairs, renewals and insurance sufficient to maintain the hereditament in a state to command the rent must be deducted from this, inasmuch as these charges fall on the hypothetical landlord. Making a final reduction of the rates, which the tenant has to pay, we arrive at the rateable value of the whole undertaking.

The above principles of rating can be best understood by looking at the following figures, which were given by Mr. Harold Eve in the course of the case of Charing Cross Electricity Supply Co., Ltd., *v.* Lambeth and Westminster Assessment Committee in 1906 :—

ASCERTAINMENT OF RATEABLE VALUE.

Gross receipts	£125,194
Working expenses	50,281
Net receipts	£74,913
Tenants' share, 17½ per cent. on £51,000...	8,925
Gross value, plus rates	£65,988
Repairs and renewals	27,341
Rateable value, plus rates	£38,647
Rates, at 7s. in the £	10,020
Rateable value of whole undertaking ...	£28,627

In London, as the rates are only revised once in five years, it is necessary to consider what year is to be looked at for the purposes of rating.

In Charing Cross, City and West End Electricity Supply Co., Ltd., *v.* City of London Union (1906, Konstam 31), the company appealed against a valuation made in 1905. The question arose as to what year was to be considered. The company published their accounts yearly—not half-yearly. It was held that the case must proceed on the basis of the company's accounts for the year 1904, but counsel for the Union were to be allowed to put questions as to the general working of the company in 1905. The Deputy-Chairman of the Quarter Sessions said :—"Sir E. Boyle (counsel for the Union) must refer only to the general results of 1905, and not to the precise figures. An electric supply undertaking is not like an ordinary business ; some other light may spring up immediately and take the place of electric light."

Hitherto we have proceeded upon the assumption that the entire undertaking of the company is situated in one parish or rating area. In such a case there is no necessity to consider whether the profits, upon which the rateable value is founded, are earned at the generating station or at the premises of the various consumers. But where, as nearly always happens, the undertaking is distributed over many

parishes, difficult questions arise. For instance, the generating station, which is only indirectly productive, may be in one parish, while the directly productive part of the works may be distributed over the company's whole area. How are the profits to be apportioned? The difficulty is got over by considering the claims of all the different rating areas together.

In dealing with this question, rating authorities have recognised the fact that the undertaking of a gas or a water company is very similar to that of an electric lighting company. The principle adopted in the case of a water company was laid down in 1847 in the case of R. *v.* Overseers of Mile End Old Town, 1847, 10 Q.B., 208. There the works of a water company extended into several parishes. The rateable value for the purposes of poor rate, of the entire works, was £30,800. The rateable value of the reservoirs, buildings, &c., valued as land and buildings deriving value from their capacity of being applied to the objects of a water company, was £6,500. It was held that the rateable value ought to be apportioned among the several parishes in the following manner:—"The rateable value of the reservoirs, buildings, &c., valued as above, to be first deducted from the total rateable value, and distributed among the parishes in which this portion of the works was situate, according to the extent of such works in each parish; and the residue of the rateable value to be apportioned among the parishes containing the service pipes, in the ratio of the net profits produced in each of those parishes." *(To be concluded.)*

THE N.S.W. GOVERNMENT POWER STATION.

A recent issue of the *Commonwealth Engineer* contained a description of the new White Bay traction power station of the N.S.W. Government Railways and Tramways Department at Balmain. The first section of this station is nearly complete and three 7,500 KW. turbine units will shortly be available to supplement the tramway service.

The station is close to White and Rozelle Bays, giving an almost unlimited supply of circulating water; it is convenient to overseas wharfage and to railway and tramway connections. The complete block of buildings to be erected will be 465 ft. long by 242 ft. wide, and will accommodate ten turbo-alternators, eight for normal use, one under repair, and one standby. At present only half the station has been erected, to accommodate four 7,500 KW. turbine units each supplied with steam from four water-tube boilers.

The four batteries of boilers comprising the first installation are arranged on either side of two firing aisles at right angles to the engine room in which the turbine units are placed cross-wise, in pairs, with the auxiliary plant between them. Each turbine, with its boilers, condenser, auxiliary plant and switchgear, forms a complete power unit independent of the others.

The boiler house—which will be divided into sections when complete—contains three floors, *i.e.*, ash basement, firing floor, economiser and fan floor, and coal bunkers are provided over each firing aisle giving approximately 1,000 tons of coal per unit, or about eight days' supply. Fuel is brought in on two elevated railway tracks, equipped with electric capstans, and the trucks, after emptying into hoppers, run down a decline and up a short incline where they strike spring buffers, causing a rebound which is sufficient to send them over automatic points on to an empty truck siding.

A fuel hopper, bucket elevator and belt conveyor (50 tons per hour) is provided to each unit; a Denison coal weigher is provided to each boiler, and the ashes from the latter are collected and discharged into a 40-ton tank over the railway, by means of a pneumatic suction ash plant. The boilers, each of 27,000 lb. evaporation, normal rating, and 40,000 lb. under forced rating, supply steam at 180 lb. pressure, 200° F. superheat. Inclined chain-grate stokers, specially designed for burning coals which are low in volatile hydrocarbons, are fitted. A 288-tube Green economiser is provided to each boiler and one Prat ejector type chimney to each pair of boilers. The boiler, coal, ash and draught plants were all supplied by Messrs. Babcock & Wilcox, Ltd.

A narrow bay between the boiler house and engine room forms the pump room, containing a 360-gallon per minute service feed pump for each unit, of the Mather & Platt six-stage centrifugal type; an emergency steam-turbine driven two-stage pump by Messrs. Mather & Platt is also provided, together with Venturi meters in the pump deliveries and Precision meters in the air-pump discharges to the hot wells.

Three Willans-Dick Kerr 7,500 KW. turbo-alternators have been ordered for the plant, one, however, owing to the conditions at the time, being installed in the Ultimo power house; a fourth 7,500 KW. turbine set was obtained from the General Electric Co., U.S.A., owing to unsettled labour conditions in Great Britain.

The Willans turbines are of the disc and drum type with a guaranteed steam consumption of 13.9 lb. per KW. hour, full load, vacuum 28.3 in. The speed is 750 r.p.m. The American turbine is a six-stage horizontal Curtis plant, running at 1,500 r.p.m.

The generators supply three-phase current at 6,600 volts, 25 cycles; the Dick Kerr machines are ventilated by independent 30-H.P. fans, and the American machine has ventilating fans attached to the rotor; a 125-volt exciter is coupled to each alternator.

Messrs. Willans supplied their own surface condensing plants, while Messrs. W. H. Allen & Son supplied the plant for the American turbine. The circulating water is drawn from White Bay and discharged into Rozelle Bay; two concrete ducts, side by side, connect the two bays passing under the turbine house from end to end. Settling chambers and revolving screens are provided in the ducts, and valves at the power house allow the direction of the flow in the ducts to be reversed and the hot discharge to kill any marine growths.

The condensers are mounted over the circulating water ducts, and owing to the syphon action between the inflowing and outflowing ducts below, the circulating pump—having once started the water flow—has merely to operate against the difference in level between the two ducts. Except for the 600-volt D.C. motors for the 50-ton engine room crane, the whole of the auxiliary motors are of the three-phase 440-volt type, mostly open squirrel cage machines, although totally enclosed and pipe ventilated motors are used in exposed situations. The H.T. switchgear, supplied by the G.E. Co. (U.S.A.), is situated in a switch house adjoining the engine room.

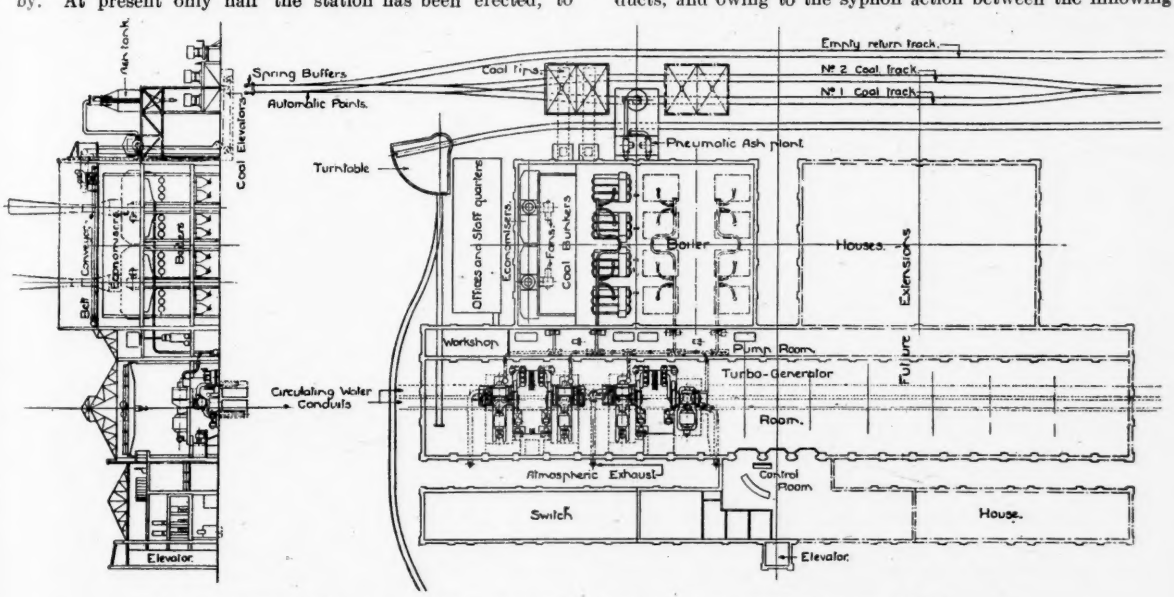

FIG. 1.—GENERAL ARRANGEMENT, WHITE BAY POWER STATION, BALMAIN, N.S.W.

The main oil switches are all of the motor operated type, while the auxiliary circuits, supplied through six 350 KW. Brush transformers are controlled by solenoid operated switches. Current limiting reactances are provided in the generator circuits, designed to give a 6 per cent. drop at normal load, but capable of carrying 150 per cent. lead continuously with a larger drop.

Aluminium lightning arresters have been installed on each outgoing feeder with a view to surge protection from this end.

In conjunction with the transformers an oil circulating system is in use by means of which the oil can be passed through a filter and dryer to a reservoir, from which it flows back by gravity to the required transformer.

The switchgear is operated by remote control, a bench board—for the generators—and feeder control board being located centrally on the switch house side of the engine room; eight sub-station feeders are allotted to each generator. A complete electric signalling system with illuminated dials is

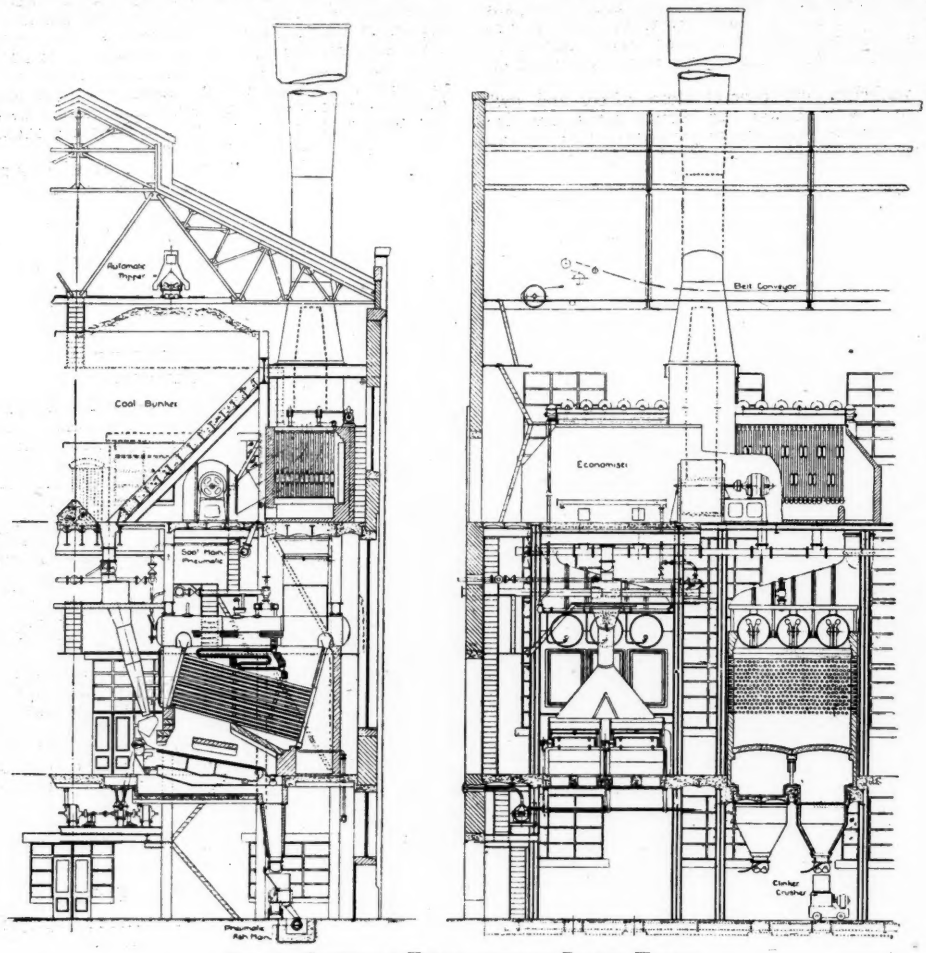

FIG. 2.—SECTIONAL VIEWS THROUGH BOILER HOUSE.

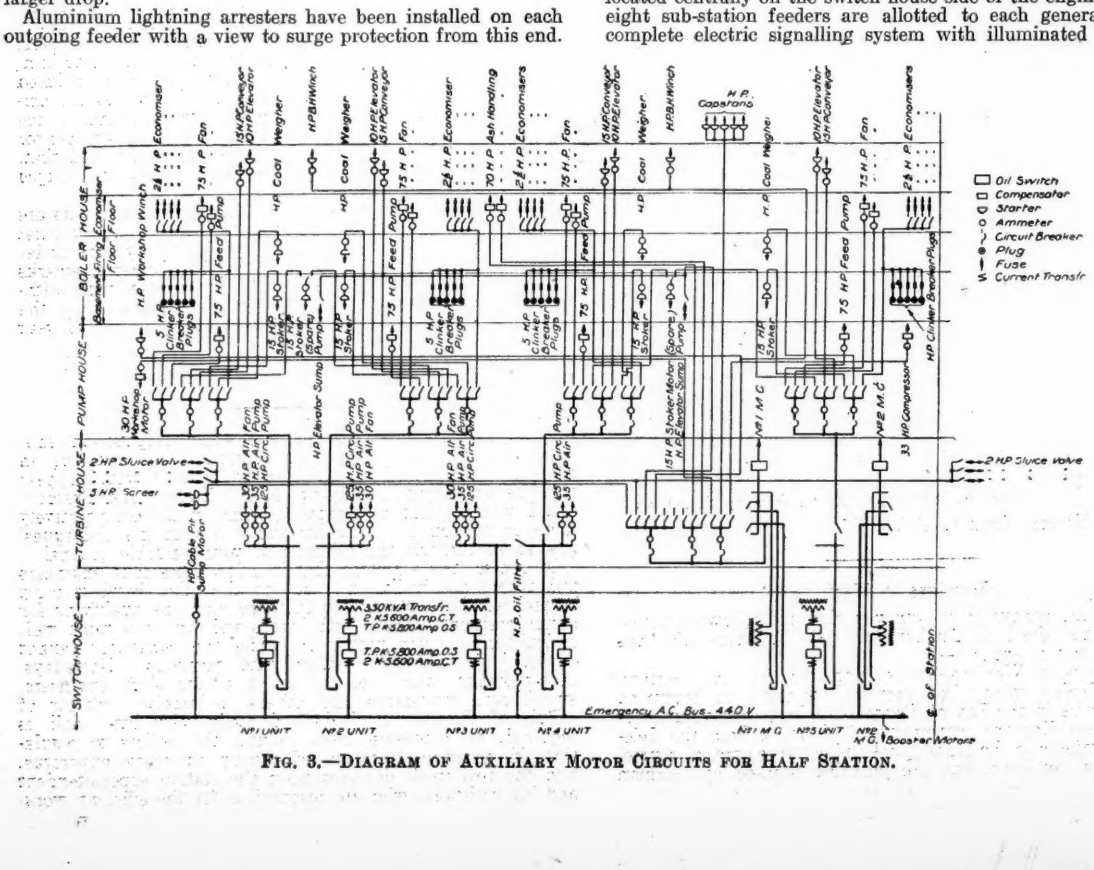

FIG. 3.—DIAGRAM OF AUXILIARY MOTOR CIRCUITS FOR HALF STATION.

provided between the control room and operating staff, while telephones, electric clocks, etc., are also installed.

The alternator leads run through fibre ducts underground to the switch house basement, to reactance coils giving a 6 per cent. reactance drop at normal load; the leads then pass through glazed brick chases to the oil switches. A ring 'bus system has been adopted; the H.T. leads are all carried in separate chases and conduits, the chases being continued on the ceilings.

A complete workshop and general store, offices and staff quarters, equipped with shower and plunge baths, are also features, while a reserve coal storage yard with crushing and loading facilities is provided at Leichhardt to safeguard the operation of the plant, from all of which it will be gathered that the Railways Department has provided for a modern installation.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

A.C. v. D.C. for Lighting.

Referring to the letter in your issue of the 8th inst., signed "X-Gas," under the above heading, your correspondent can set his mind at rest as regards the suitability of low periodicity alternating current for lighting. Current at 40 cycles is used in a great part of Cardiff, and as a matter of fact this letter is being written by its aid. Quite a number of small towns and villages in South Wales are lit by current at 25 cycles, supplied by the South Wales Power Co., and my own house is so lit. Personally, I have not experienced the least inconvenience.

More than this, a very large number of the collieries and works are being supplied by the South Wales Power Co., and I know that where this current is used for the lighting of machine shops, it is found to be entirely satisfactory. Occasionally one comes across a metal-filament lamp with rather loose filaments, and these vibrate in synchronism to the periodicity, but even in such cases, where a Holophane or other shade of similar type is used, the vibration effect is entirely lost.

Theodore Stretton.

Cardiff, *January 12th*, 1915.

Garage Heating.

With reference to "Interested Inquirer's" letter in your issue of January 8th *re* above, in my opinion your correspondent has been ill-advised to install a radiator of the red-hot element type. While it is true that the normal temperature attained by these elements may not be sufficient to ignite an explosive mixture of petrol vapour and air, there is always present in a garage some dust in the form of particles of lint, say from brushing the upholstery down, or straw, etc., which will almost assuredly incandesce in contact with the red-hot elements, and be sufficient to ignite the mixture or petrol vapour.

I have seen a motor-cycle set on fire by a smoker drawing at his cigarette when the carburettor was flooding, the incandescence from the edges of the paper doing the trick.

The safest possible heater to use is the electric convector or air warmer. Several types are to be had of small dimensions, notably the circular tube type with perforated case, 500 or 1,000 watts.

A plug should *not* be fitted on the heater, or if one is fitted on a standard it should be fixed up so that it cannot be removed, as the flaming sometimes caused when putting the plug on might be fatal to spare petrol, not to speak of the car.

If it is desired only to keep the water from freezing, one of the small immersion heaters dropped in the radiator tank through the filler cap and suspended by a stop of some kind to prevent its total immersion over the terminals is a good plan. An electric flat-iron has been used for this purpose by placing it against the bottom face of the car radiator, but this is not fair to the flat iron.

Chas. H. Archer, *Electric Heating Specialist.*

King's Norton, *January 11th*, 1915.

Wireless in Warfare.

I have the honour to inform you that the following notice in your periodical of October 2nd, 1914, on page 470, has attracted my attention:—

"Wireless in Warfare.—It is suggested that the German cruiser *Emden*, which has been so successful in capturing British ships in the Bay of Bengal, has been receiving information regarding the movements of shipping from the Telefunken stations in the Dutch East Indies; these are, of course, on neutral territory, but are probably worked by German officials."

With respect to this notice I am obliged to give the following rectification:—The wireless stations in Netherlands East-India are owned by the Government and are operated by Netherlands officials only, who during the whole war time have got and strictly followed the most positive orders with regard to maintaining our neutrality. No German or any other stranger has been on the stations or is allowed even to enter the grounds, as the stations are under constant watch of the military department. Moreover, I am able to contradict most positively that the German cruiser *Emden* received any telegrams or any information from the operators regarding the movements of shipping.

I should esteem it a favour if you would be kind enough to publish as soon as possible a rectification in that way.

Batavia, *December 4th*, 1915.

G. R. C. Plop,
The Chief of General Direction of Posts, Telegraphs and Telephones in Netherlands, India.

[We are very pleased to publish this letter, and regret that the Dutch stations were unjustly accused of a breach of neutrality.—EDS. ELEC. REV.]

Wonderful Accumulator Cells.

It is not necessary for me to answer Mr. Faraday Hawdon's questions, because he answers them himself. I am sorry that he cannot "follow the inference suggested by the statement," "The positive plate is now of normal size"; perhaps others can. I am quite well aware of the behaviour of separators, made of unsuitable celluloid, in storage batteries, both large and small. Troubles too numerous to mention were experienced through these twenty years ago in large 61-plate cells. One large firm used asbestos cloth, and kaolin separators were used by Niblett & Sutherland, in their Umpire cell; they are still used for small cells to-day by two firms, differing only in design. Their disadvantages, under certain conditions, are quite obvious, especially when packed tightly between the plates, and very little room left for acid.

Corrugated and perforated ebonite separators are used in many first-class small batteries, and these give no trouble; for large batteries where an efficient separator is required, nothing beats the standard wood diaphragms, properly treated in order to free them from pyroligneous acid, and vasculose, and placed mid-way between the plates so as to allow free access of acid, and to permit free movement of the ions, escaped gas and perfect diffusion.

A. W. B.

Newcastle-on-Tyne, *January 16th*, 1915.

Salaries of Junior Engineers.

A senior assistant of my acquaintance employed in a neighbouring sub-station of 3,000-KW. capacity has recently been "on the carpet" twice, owing to trouble caused by the incapability, negligence and lack of knowledge on the part of the junior assistant under him. The senior had long service with his employers and, previous to the trouble, a clean sheet. The junior, on joining the supply company, was quite "raw" in regard to central station work and plant, and, moreover, too young to undertake the responsible duties assigned to him. The senior has, in consequence of the trouble, been reduced in status and position. All the facts are known to the employers—they holding that, no matter what happens, the senior is to blame and the junior is in no way responsible for any mishap due to his actions. The company also add that, owing to the shortage of unskilled labour, they are obliged to take who they can get.

Ought the skilled men to suffer because the employers are experimenting with unskilled labour? If this is the general attitude of employers, I pity those having raw youths under their charge during the present crisis. Mr. Ebben's remarks are only too true. Employers can afford to be reasonable without being half as hard hit by present conditions as are the poor devils grinding out 56 hours a week, year in and year out, for a paltry 30s. or so.

J. Kay.

Manchester, *January 16th*, 1915.

Our old friend, Mr. Ebben, has again cropped up and, judging from the tone of the paragraph last but one in his effusion published in your current issue, it would appear that he is rapidly qualifying as a "Hyde Park Orator," and I wonder that he wastes his time in the comparatively tame occupation of airing his and a few of his colleagues' grievances through the columns of your valuable journal.

Of course it is admitted that in a few cases shift engineers and others are badly paid, but on the other hand it must be realised that the smarter of these men are qualifying for better positions. Those with brains and who like work will, undoubtedly, obtain promotion while the remainder cannot expect high wages for subordinate positions. Nowadays, central-station work, so far as it affects shift engineers, switchboard attendants and others, is largely a matter of "Rule of thumb" methods and really very little skill is required, all processes, from stoking the boilers to regulating the pressure, being caried out by automatic apparatus, and the real work devolves upon the station superintendent and his assistants who are responsible for the efficient work-

ing of this automatic apparatus. In my humble opinion the day of the "collar and cuff" shift engineer has gone, and I would infinitely prefer to have the services of a good, steady experienced engine driver in charge of his shift rather than those of a young inexperienced college man who, when trouble occurs, has necessarily to rely upon the above-mentioned driver to put him right. When things are going well our young college-trained gentleman usually spends his time in playing cards with his switchboard colleague or in some other amusement, while the driver does the work.

If Mr. Ebben himself is a shift engineer he will probably know that my judgment is correct, but as he has always maintained that these gentlemen are overworked I doubt whether he occupies such a position, as if so he could scarcely find time to adopt the rôle of a "Trade Union Agitator" in addition to his multifarious duties. I should strongly advise him to form his Association into a recognised Trade Union, when in addition to being able to air his views without restraint, he, as Organising Secretary, would have a very much better job than he is ever likely to get in a supply undertaking.

Experienced.

Preferential Terms for Arc Lights for Photo Printing.

Referring to your note on Mr. H. Faraday Proctor's letter on this subject on page 86 of the current issue, one is a little surprised to see a point of this kind raised, because it appears to be generally understood that electricity used for trade purposes, and not for illumination, should get preferential treatment. On several installations which come under my supervision electricity is supplied at special rates not only for the arc lights used for photo-printing, but also for the red and yellow lamps used in the dark rooms for delevoping. In both cases the lamps are used for trade purposes, and not for illumination; in fact, the rooms are artificially darkened to keep out daylight so that the processes may be carried on during daylight hours. For the same reason that this class of work is supplied at special rates, so also is battery charging when carried on during day time, although the stored energy is afterwards used solely for lighting purposes; a motor generator, however, would not be entitled to motor rates if used for lighting purposes.

Preferential terms are given not because the electricity is used for lighting, or power, or heating, but principally because it is used during the hours of daylight, when the demand for lighting is small

London E.C., *January 15th*, 1915.

Frank Broadbent.

I notice that the legal correspondent of the *Municipal Journal*, in the issue of January 15th, states that "he is unable to change his opinion," but by his own words he admits that my contention is right, viz.: That the ultimate purpose for which electrical energy is used is to be taken into consideration in determining whether such use is lighting, power or heating. In the issue referred to he says:—"But in law and in fact such undertakings do charge according to whether the energy is for lighting or power. A reference to the analytical tables in the 'Municipal Year Book' shows this beyond dispute." I may only add that it is equally beyond dispute that electrical energy used for photo printing is not "energy for lighting," or to employ the more correct term, "for illumination purposes."

H. Faraday Proctor,
Hon. Sec., I.M.E.A.

Bristol, *January 18th*, 1915.

[We refer to this matter in our leading columns.—Eds. Elec. Rev.]

Advertising and Character.

I do not agree with your correspondent, who states that "an advertisement does or should reflect the character of the firm issuing the announcement." Very artistic and clever advertisements have before now been employed to advertise comparatively worthless productions, and one need not go outside the confines of electricity to add "notorious swindles." On the other hand, I hold that advertisements should be designed to attract the character of the individual whose enquiries are solicited. This is a very different proposition, and calls for a recognition of the diversity factor in the human mind. None of the theories put forward up to now in this correspondence is wholly confirmed by my experience as an advertiser. While each of the suggestions put forward may be sound, they would, in my opinion, only be separately effective, and in a limited sense, and each would fail by repetition. Were I a professional advertiser, I should deem it necessary to appeal in turn to the diverse personalities we know to exist; in other words, to "ring the changes." One only needs to peruse your correspondence columns on this subject to realise the variety of taste there is to cater for. There is the man with æsthetic taste and the man without; there is the man who appreciates detail and the man who, having no time for it, turns the page over quickly. There is "Consultant," who objects to be reminded of a special brand of whisky during his comic intervals, and his antithesis who would welcome such a reminder under any circumstances. There is the man (Mr. E. I. Hill reminds us) who always reads his technical journals during business hours, and is not in the right frame of mind to be amused, and there are the men, myself included, who never read those journals during office hours, and therefore welcome a little mental relaxation by way of humour in the advertising and editorial columns.

Then there is the British reader in the Colonial market who plumps for British solidarity; the Canadian in the same market who finds British methods leave him with "cold feet," and who searches for the latest American "stunt"—and, finally, a large community who object to advertisement in any and every form. Obviously it is impossible to attract everybody at once, so again I say, "ring the changes."

I have advertised in technical journals for many years and with varying success, and it may interest the votaries of publicity to know that the advertisement to which "Consultant" referred in his "critique" is the only one I have ever caused to be inserted which has brought letters of congratulation from all directions, many of them enclosing valuable and lengthy enquiries. Truly, its complete success was marred by a regrettable oversight. Owing to my enforced absence from the office when giving written instructions, I completely overlooked the fact that our mailing list includes the names of a few people who probably do not read the Electrical Review. Such people only received one-half of my message, and the other half revealing my identity, being in the advertising columns of the journal, I fully realise that it must have been extremely annoying to the Electrical Review to be asked for a copy or to be bothered in any way in connection with a matter in which they had no concern whatever. Undoubtedly the postcards should have borne my company's address; it would have improved the value of the advertisement without diminishing its exceptional effectiveness. As I have remarked, that was an oversight for which, the circumstances being known, I hope I am forgiven. But here again is a strange anomaly. Some of the most complimentary replies were received from people who stated that they had quite a difficulty in obtaining a copy of the magazine, and this appears to have given them quite an added interest in the advertisement.

In conclusion, if any of your correspondents are sufficiently interested to care to see some of the original remarks the advertisement evoked, I shall be most happy to show them.

Herbert Berry.

Hove, *January 19th*, 1915.

With further reference to the above and to Mr. E. J. Reed's remarks in your current issue to the effect that "Technical Advertisements have special consideration," I would like to add that I consider that to be a thorough advertising man a sound acquaintance with technical terms, and buyers' and users' requirements is essential in at least 90 per cent. of the trades which employ publicity. That this is so may be either known from sufficient personal experience or clearly seen in many rubber, electrical, petrol, motor and general engineering journals where publicity work is turned over by manufacturers to general advertising agencies who place the copy and designs. The inevitable results are always very flat, sometimes pitiful. In the case of commodities which appeal to the crowd, the general "fluent" professional advertisement writer is good enough, as the crowd are not technical in their requirements in respect to pills, plasters and cure-all balms.

In stating that his reason for prefering British to American advertisements is the same as that which prompts him to prefer a gentleman to a costermonger, Mr. Reed leaves himself open to be caught in his own trap, as the average costermonger is far superior to the average gentleman in business instincts and aptitude. As an American by instinct I thank your correspondent for his somewhat subtle, though unintentional compliment.

Arthur Mallord Turner.

London, S.W., *January 18th*, 1915.

Jowers Protective Leakage Device.

Although I have not seen this device and can only go by the description recently given, it would seem that the remedy may easily be worse than the disease.

In the first place the device only operates on one pole. Should an earth occur on the opposite pole, and the starter arm return to the "off" position, current will still continue to flow through the fault and probably bring the breaker out. In the event of the earth being on the same pole as the starter and the device operating the whole of the current through the fault, at practically the line voltage (less of course in a three-wire system), would be broken on the starter arm and first contact. This would be bad for the starter. Again, take the case of the "heedless operator" making persistent attempts to start up the motor with the fault on it. To energise the trip coil it is necessary, according to the diagram, to get the starter arm on the first contact. If the "heedless operator" held the arm there for any length of time he would in all probability burn out the resistance, while if he let go of the handle he would stand a good chance of getting burnt by the resulting arc. In conclusion, if it is seriously intended to place this device on the market, I would suggest that the insulated wire be taken to the trip coil via the frame of the starter or control panel as this is quite as liable to trouble as the motor.

Ernest F. Butler.

London, W.C., *January 18th*, 1915.

Stray Magnetism from Tramway Feeders.

A jeweller in this town complains that owing to one of our tramway feeders being within 10 ft. of his shop window the watches in his shop become magnetised, and an ordinary compass fixed in the window certainly shows considerable movement. I should be very much obliged if any of your readers would explain this, and, if possible, suggest a remedy. Our cables and insulation are in good order, and so far as I know there is no leakage from the tramways overhead equipment.

The jeweller's shop has been in its present position for about six years, and it is only within the last few years that the watches have become magnetised, and within the last six months more than usual. If you, or any of your readers, could give me a solution I should be extremely obliged.

Magnet.

[At the distance stated, a current of 1,000 amperes would produce a field of less than 1 C.G.S. unit.—EDS. ELEC. REV.]

WAR ITEMS.

Australians and Electrical Contracts.—According to a report in the "Sydney Morning Herald," the Sydney Council Electric Lighting Committee on October 26th affirmed the principle of British preference. We quote our contemporary's statement without alteration in order that the reader at home may observe how these matters are viewed in Australia. "Several tenders for electrical supplies had been received, including one from an American firm and another from a German firm. Alderman Meagher said he did not intend to make a spread-eagle display of patriotism, but, taking a cold common-sense view, he thought they would all see the wisdom of giving preference every time to Empire-made articles. He moved that a recommendation be made to the Council that, during the currency of the war, a preference to the extent of 10 per cent. be given. He was inclined to make the margin still bigger, but the Federal tariff, he believed, already gave a slight preference. Alderman Lindsay Thompson considered that they should not only give preference during the war, but for all time. He hoped that the Council would set an example to the public, and not go crawling back to the cheapest market, irrespective of what market it was, as soon as the war clouds rolled away. Alderman Hagon stated that he had been informed that no less than 90 per cent. of the firms trading in electrical goods in England were actually German firms, although they did not all bear German names. Some of these companies had an English director holding a few shares, but the great bulk of the profits went to Germany. The Council, therefore, needed to be very careful how it acted. Alderman W. P. M'Elhone remarked that, in view of this statement, they might actually give an advantage to a German concern under a British name if they failed to make the fullest investigation. He was in full sympathy with the motion. Alderman Meagher suggested that each tenderer be requested to furnish a certificate containing certain data. Ultimately the matter was left in the hands of a sub-committee, consisting of Aldermen Stephen and Meagher, the Town Clerk (Mr. Nesbitt), and the City Electrical Engineer (Mr. Mackay)."

The War and Factory Premises.—In their report for 1914 Messrs. Leopold, Farmer & Sons, of Gresham Street, E.C., state that the year was far better than 1913 in respect of sales and letting of factory property, wharves, land, etc. This result is in a large measure due to the war, which has produced a demand for factories and commercial property, partly to war equipment, and secondly for the manufacture in this country of goods previously imported. The firm report that an unprecedented demand still exists for properties of all kinds, and they have disposed of a large number of factories with and without plant and machinery at figures running into many thousands of pounds. Premises that previous to the war had failed to find tenants for years have been rapidly taken up, owners in many cases having obtained increased prices through competition. The firm add: —"The Declaration of Peace should mean the opening up by our manufacturers of an enormous overseas trade both with our colonies, new possessions, and the world's markets in general, and then will come the time for us to 'capture the trade' hitherto to a large extent held by Germany. We can safely say the outlook for further deals in factory property is good, and think we are justified in hoping to report a continuance of the demand and supply of commercial properties of all descriptions in the present year."

Capturing German Trade.—Referring to the note in "War Items" in our last issue concerning the Board of Trade Electrical Exchange Meeting, the Walsall Electrical Co., Ltd., inform us that they are manufacturing milli-ampere meters similar to those on exhibition, and are also making various pocket type meters which were illustrated. They have every confidence in stating that as soon as the labour and material markets resume their normal conditions they will be able to supply these various items at the same price as the Germans and Austrians have hitherto sold them at. They have on their books at present orders for over 800 milli-ampere meters, the greater portion of which are for use in connection with telegraph and telephone work, and about one-third for use in connection with medical work. The company state that they are laying themselves out "to manufacture certain items in large quantities, and thereby departing from the usual practice of British manufacturers of making everything but making nothing well." It is only by receiving support from the wholesale houses and exporters that they will be able to do so, and they look with every confidence for this support. We congratulate the company on the enterprise exhibited, and hope that the results will be all that they could wish.

The Industrial Situation in Denmark.—The director of the Northern Cable & Wire Works, of Copenhagen, is reported to have stated in a communication to a local newspaper that great difficulties are experienced in connection with the procuring of the requisite stocks of lead, copper and rubber, and that, in his opinion, the export veto of the Danish Government ought to be sufficient security to the British Government against any re-export of these materials to Germany. Nevertheless, the British Government prevents the export of such materials which have been purchased by Danes in England, and also hinders the obtaining of supplies from America. As a consequence, it is said that the Danish copper and lead rolling mills and the lead cable works have been compelled to suspend their activity, whilst the electrical firms and other industries keenly feel the effects of the prevailing scarcity of raw materials.

Sydney Municipal Council and its Contracts.—Our contemporary "Tenders" states that the following recommendations have been made by the Sydney electric lighting committee:—That in connection with contracts which have been affected by the war, the following be approved and adopted:—

(*a*) That the Council allow to a contractor, as an extra on his contract price, in respect of contracts entered into before the outbreak of the war, the extra freight and insurance paid by him in consequence of the war, not exceeding the actual amount of his actual loss. That the contractor be asked to satisfy the Council's general auditor upon this question in any case where a contribution is sought.

(*b*) With regard to contracts, tenders for which were received before the outbreak of war, but acceptances of which were not sent out by the Council until after the outbreak of war, the Council's acceptance be of the tender at the price mentioned in the tender, with the extra freight and insurance (if any) which the contractor can show to the satisfaction of the general auditor he has been compelled to pay over the ordinary rates, the extra amount being due to the abnormal conditions caused by the war.

Board of Trade Assistance.—In connection with their campaign to assist British manufacturers and merchants to secure trade formerly in the hands of German or Austro-Hungarian firms, the Board continue to receive a very large number of inquiries for the names of sellers or buyers of articles of which the sources of supply or market have been interfered with by the war. The seventh list of articles which inquirers desire (a) to purchase and (b) to sell, is now ready and may be obtained, together with copies of the previous lists, on application to the Branch.

Telephones Wanted.—With reference to the appeal of the National Service League for telephones which appeared in our issue of January 1st (page 17), we learn that generous and greatly appreciated assistance has been rendered by Messrs. J. B. Saunders, Ltd (railway telephones), General Acoustics & Dictaphone Co. (loud speaking telephones), and the Western Electric Co., Ltd., who are sending two of their Lister portable telephone sets of the regular military pattern. Probably there are others who have such apparatus that they will be willing to place at the disposal of the League.

Prices of Installation Materials in Germany.—It was reported about the middle of December that the prices of installation materials had been advanced by the Bergmann Co. by 10 per cent. in consequence of the increased cost of all raw materials and partly finished manufactures, particularly in the case of metals, and that other firms would probably follow the example. It is now announced that the syndicate of makers of installation materials has raised prices by from 10 to 25 per cent., owing specially to the greater cost of copper and rubber.

The R.A.C. and X-Ray Apparatus.—The "Auto-Cycle Journal" states that a subscription has been started at the Royal Automobile Club with the idea of presenting a full X-ray apparatus with a petrol-electric set to supply the necessary current to the Officers' Base Hospital at Havre.

Blackpool Lights.—The arc lamps on the Blackpool Promenade are being blackened on the seaward side, in anticipation of an order by General Adam, commanding the Territorial Division in Blackpool.

Manchester Roll of Honour.—A roll of honour has been prepared by the Manchester Tramways Department on which the names of 1,232 employés of the tramway department who are serving with the colours have been inscribed.

Personal.—Mr. Edward S. Carling, who has represented the Electrical Co., Ltd., in the South of England for the past ten years, has been called up under the householders' return, and has joined the Royal Engineers.

Mr. C. J. Oake, second engineer-in-charge at the Bermondsey Electricity Works, has obtained a commission in the Army.

Roll of Honour.—Sergt. Wm. Deakin, of the 1st Manchester Regt., for five years a car-driver in the Salford Corporation Tramways Department, has been killed in action. He was 32 years of age, and had served in South Africa.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Adapter for Small Cooking Apparatus.

When an electric kettle, say, is connected to the circuit by plugging into a lampholder, the lamp is necessarily put out of use for the time, and is liable to be broken in repeated handling. To do away with this inconvenience, the GENERAL ELECTRIC CO., LTD., of 67, Queen Victoria Street, E.C., have patented an adapter, illustrated herewith, which keeps the lamp in use. It will be seen

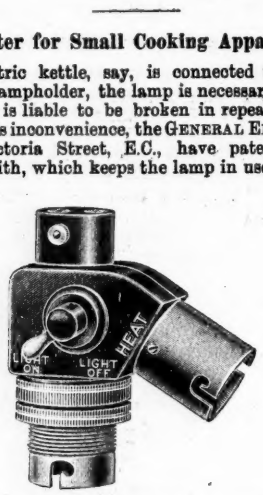

FIG. 1.—G.E.C. TWO-WAY ADAPTER.

that the device consists of a two-way fitting, the lower way receiving the lamp, and the side socket providing for the heating circuit. A litttle turn switch enables the lamp to be lighted or extinguished, as desired, without interfering with the heating circuit. The latter may take up to about 3 amperes. Small nuts on the pins of the plug enable the adapter to be fixed firmly to the lampholder.

Henley Fuse-Boxes.

MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., of Blomfield Street, London Wall, E.C., have for some years specialised in self-contained fuse-boxes and sealing chambers, and we illustrate in fig. 2 one of a number of similar devices contained in their latest list of service fuse-boxes. The figure illustrates a 20-30-ampere D.P. fuse-box with hinged cover, and below, and combined with it, is a three-way sealing chamber.

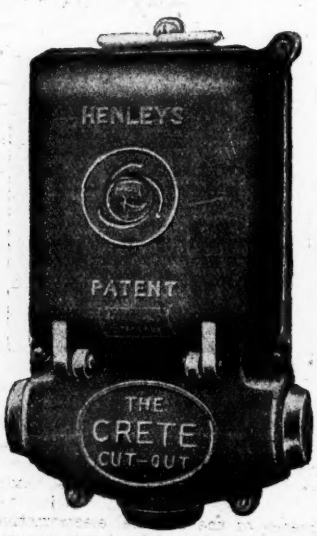

FIG. 2.—HENLEY FUSE-BOX AND SEALING CHAMBER.

This set is very compact, weighing only 4¾ lb., and measuring 8½ in. long × 5 in. wide × 2¾ in. deep overall.

A particular feature of these cut-outs is the separation of the sealing chamber from the fuse chamber by a horizontal iron diaphragm cast integrally with the box, the holes through which the bare conductors pass to the terminals being insulated with porcelain bushes. The sealing chamber is designed to take either vertical or horizontal service cables.

Veritys' Fixtures.

A new edition of Vol. 3 of their catalogue of electric supplies has been issued by MESSRS. VERITYS, LTD., of King Street, Covent Garden, W.C. It is a fine production of more than 500 pages, and in the work of illustration, which is most excellently and lavishly done, a highly glazed art paper lends considerable assistance. The volume is a business-like production, and in style, size, &c., is uniform with Vol. 2, to which we referred several months ago, though, of course, it is bulkier. Introductory notes in the English, Spanish and French languages are followed by serviceable general codes, including measurements and technical and commercial phrases. By the way, the firm is shortly to publish a schedule of prices and particulars in the language and coinage of various countries, a further effort in the Verity bid for export trade; there is nothing so likely to win the favour of the foreign purchaser as putting before him in his own tongue, and in ways that he can understand, the information

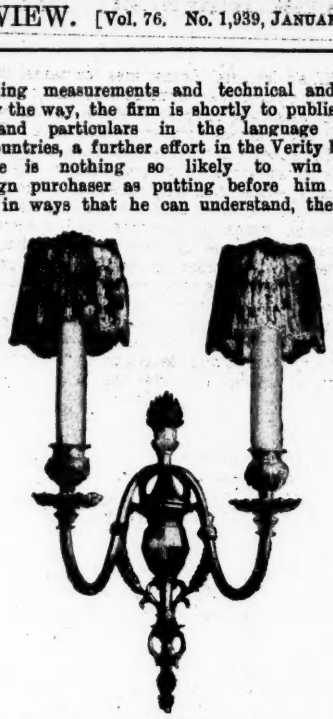

FIG. 3.—VERITYS TWO-LIGHT BRACKET.

of which he is in need. Alphabetical and numerical sections lead us to the descriptive and illustrative part of the catalogue, which is divided up into 18 sections. We might enter into a great deal of comment by way of eulogy, perhaps tempered with only a very small amount of the spice of mild criticism, concerning the hundreds of varieties of designs and types that are illustrated and priced, but seeing that a fittings catalogue is intended for all tastes

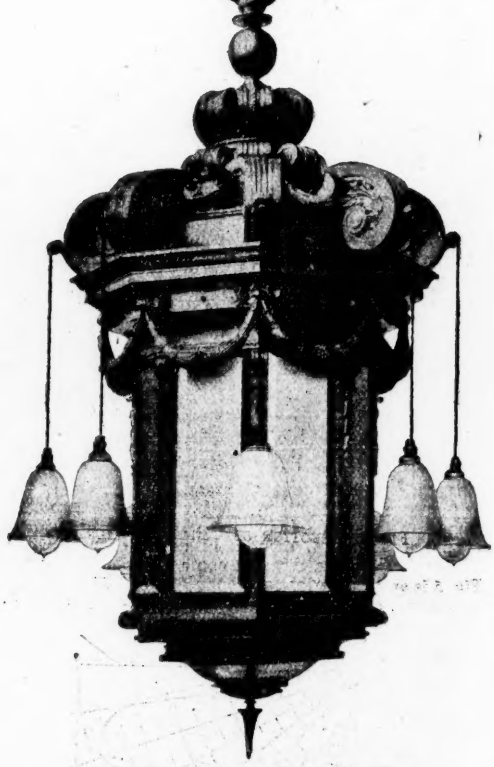

FIG. 4.—LANTERN FOR ENTRANCE HALL.

and all types of men—and women—whatever we might say could not be representative of anybody's thoughts save our own, and in matters of detail such as this that is not called for. Some of the fittings lead us on to thoughts of marble halls and country houses, others into industrial surroundings such as obtain in mills and factories, others into the ships in the North Sea, yet others into hospital life, or into the streets which will be better lighted again someday, and to shops which will light electric signs more brilliantly

when little Willie's Imperial Father sues for peace, but we forbear, and fall back upon the prosaic summary of the contents given in the front of the catalogue in order to show the character and the wide extent of the fixtures covered in the book. This summary runs thus, and it appears in the three languages already mentioned (as do also the illustrations, of course, though the accompanying matter does not):—One, two and three-light brackets, pendants and indirect and sliding ditto, shade and ceiling lights, electroliers, standards, French brackets, lanterns and electroliers, bronze statuettes, hospital fixtures (a complete selection of designs), radiators, watertight and street lighting fixtures, signs, glass shades and bowls (here the firm does not conceal its regret that British glass makers have been remiss in the past and it indulges in a forecast that such will be a less pronounced weakness in the future), silk shades, switchplates and accessories. We select a couple of examples of fittings for the purpose of brightening this notice, though we cannot expect thereby to do more than give the reader a taste to see those on the other 400 odd pages. Our fig. 3 is an example of two-light bracket work, and fig. 4 is an impressive lantern form of electrolier suitable for the entrance hall of a large public building. That Veritys is a British house, that it is perhaps the oldest house associated with our electrical industries, that it has long specialised in the design and manufacture of electric light fittings, are matters upon which it is hardly necessary to dwell at this date, but when so much is being said about the constitution, &c., of different firms, it should be made clear here that its capital, directorate, management and staff are "entirely British." It may also be added that large stocks of the manufactures here catalogued are on exhibition at the firm's various showrooms in London and the provinces, that most of the contents of the book are easily adaptable for the requirements of the Canadian, South American and Continental markets, and that the firm will welcome applications for copies of this handsome volume.

Street Lighting Fitting.

THE WARDLE ENGINEERING CO., LTD., of 196, Deansgate, Manchester, have sent us particulars of a fitting designed to eliminate upward rays, and give wide distribution of light on the ground, which should be very suitable for use under the existing lighting *régime*.

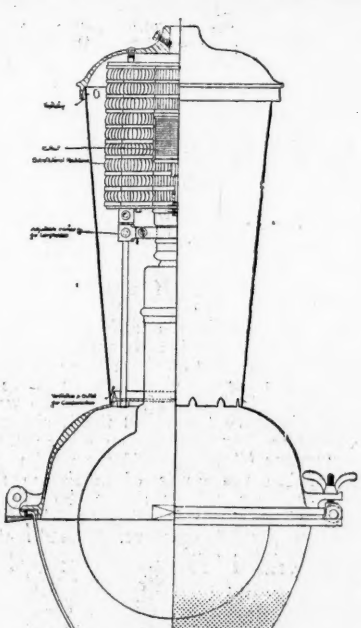

FIG. 5.—SECTION OF "PRIMUS" LANTERN.

Fig. 5 is an illustration of the No. 515 Primus lantern, from which it will be seen that the filament does not project below the

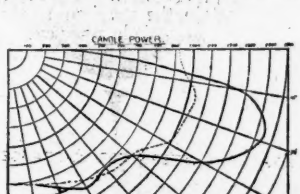

FIG. 6.—POLAR CURVE OF "PRIMUS" LANTERN.

bottom of the internal reflector. The polar curve, fig. 6 (taken by the Manchester Corporation testing department) shows an increase by nearly 50 per cent. of the candle-power at 17° below the horizontal; if the height of the lantern is 25 ft., the 17° ray will reach a radius of over 80 ft., whereas a 30° ray will only reach a radius of 44 ft. To obtain even illumination it is, of course, very important to get the maximum candle-power very near to the horizontal, but this is very difficult if upward rays and glare are to be eliminated.

THE MAGNETISATION OF IRON.

BY J. S. NICHOLSON, B.Sc., A.M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *at Glasgow, December 8th*, 1914.)

IN the testing of iron stampings at high flux densities by means of alternating currents, great difficulty is experienced in maintaining an electromotive force of sine-wave form at the terminals of the magnetising winding, and in ensuring that the electromotive force induced in the windings of the tester shall also be of sine-wave form.

If the induced electromotive force varies according to a simple sine function of the time, then the flux density in the core of the tester will also vary according to a simple sine function of the time, so that B_m the maximum value of the flux density can be obtained in the usual way from the induced electromotive force and the number of turns in the secondary winding, &c.

If, however, the flux and therefore also the induced electromotive force do not vary in this way, it becomes difficult to ascertain, even approximately, the value of the maximum flux density in the core corresponding to a particular value of the induced electromotive force. The author shows how at flux densities with maximum values of 20,000 lines per sq. cm. and upwards in Stalloy the flux in the tester core was approximately maintained as a simple sine function of the time.

Some idea of the possible divergence of the wave-form of induced electromotive force from the simple harmonic form, and of the magnitude of the error in B_m when calculated, may be obtained by a study of the oscillograms reproduced in fig. 1. These were obtained from a ring tester connected between two lines of a 40-K.V.A. star-connected three-phase alternator giving an electromotive force of simple sine-wave form on open circuit. The induced electromotive force in a search coil corresponded to values of B_m of 17,500 and 20,000 lines per sq. cm. respectively, but the actual values were 16,600 and 18,100 respectively.

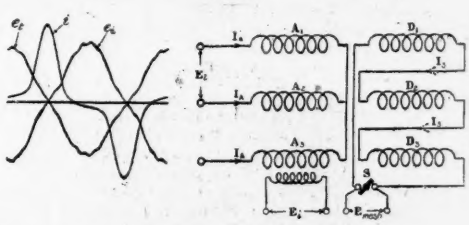

FIG. 1.—OSCILLOGRAMS OF e_t, i AND e_i.

FIG. 2.—THREE SIMILAR RING TESTERS EACH WITH TWO MAGNETISING WINDINGS, A AND D, UNIFORMLY DISTRIBUTED. THE A WINDINGS ARE STAR-CONNECTED, AND THE D WINDINGS MESH-CONNECTED AND SHORT-CIRCUITED.

The above results are typical of what may be expected when tests at high flux densities are being carried out with an alternator of medium size, and they illustrate how misleading would be a curve showing the number of watts lost in the iron core of the tester if such a curve were plotted against the induced electromotive force or against B_m (apparent). The correction which must be applied to the apparent value of B_m increases so rapidly that it is probable a point may soon be reached at which, with increasing terminal electromotive force, the maximum value of the flux density in the tester core actually begins to decrease.

The divergence of the terminal electromotive force from the simple sine-wave form is mainly due to the presence of higher harmonics in the magnetising current.

In order that each of the harmonics of this current may be maintained in the circuit of the tester and alternator there must be an electromotive force of corresponding frequency acting in the circuit. If we assume that there is no third harmonic in the alternator's induced electromotive force, then the only possible source of this electromotive force is the tester. The tester behaves like a frequency converter, taking in power from the alternator at the fundamental frequency f, and delivering power to the circuit at frequencies $3f$, $5f$, $7f$, &c.

The author has been experimenting for a considerable time with testers having two distinct magnetising windings. One of these windings carries the triple-harmonic component of the magnetising current, I_3, and multiples thereof, while the other winding carries the fundamental and all other components of the magnetising current.

A simple method of isolating I_3 and of limiting the magnitude of the electromotive force, E_3, necessary to produce I_3 is illustrated in fig. 2. The magnetising windings, A_1 are supplied with currents I_A from a star-connected three-phase alternator, giving a

sine-wave electromotive force on open circuit. The currents, I_A, will have no third harmonics, but they will include the 5th, 7th, 11th, &c., harmonics. The D windings, being mesh-connected, can only carry currents of triple frequency, or multiples thereof.

With switch S, in mesh windings D, closed, the resultant mesh voltage, 3 E_3, sends a current I_3, of triple frequency round the mesh circuit. This secondary current, I_3, and the primary current, I_A, combine to give a total magnetising current, $i = i_A + i_3$, this producing a flux which is very approximately of simple harmonic form. The resultant mesh voltage, 3 E_3, becomes very small, since it is now approximately equal to $I_3 \times 3 r_D$, where r_D is the resistance per phase of the windings D.

Oscillograms of I_A, I_3, I, E_i per phase, and E per line of three-phase alternator, are given in fig. 3.

Instead of allowing the iron cores to generate their own third-harmonic electromotive force and current, we may entirely eliminate the triple-harmonic component of the induced electromotive force, and also avoid the determination of the mesh copper watts by connecting the terminals of the mesh circuit to a single-phase alternator giving an electromotive force of the required frequency and magnitude. The resulting current, I_3, is then adjusted in magnitude and in phase with reference to the current, I_A, in the star-connected windings until the resultant induced mesh voltage is zero, and, neglecting terms of frequency $5f$, $7f$, &c., the flux density in the cores varies according to a simple harmonic law. Experiments on these lines have been carried out by the author at intervals during the past 18 months and a number of interesting results have been obtained.

Tests were carried out at 22·5 and 15 cycles per second. The results are given for temperatures of the Stalloy cores of 55° to 65° C. The B-H curve, fig. 4, for the Stalloy cores was obtained by the method of reversals. The core losses have been analysed in the

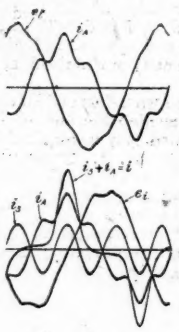

FIG. 3.—OSCILLOGRAMS WHEN B_m (APPARENT) = 17,500.

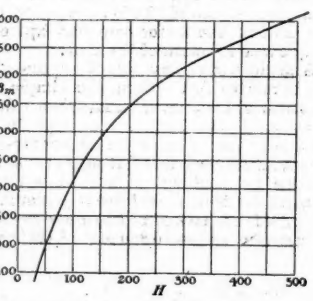

FIG. 4.—B-H CURVE FOR STALLOY CORE.

usual manner into hysteresis and eddy-current losses, and curves of hysteresis losses plotted against B_m are also shown in fig. 5.

The index of B_m in the hysteresis formula was found to be 1·58, from 17,500 to 19,500 lines per sq. cm.

For values of B greater than 19,500 lines per sq. cm. the index seems to be greater and the constant, η, smaller. The flux density in the tester cores consisted mainly of a simple sine function of the time with a very small fifth harmonic ripple which did not exceed 3·2 per cent. of the fundamental term. The total corrections at 22·5 cycles per second amounted to 1·6 per cent. at B (apparent) = 18,000, and to 4·15 per cent. at 21,000.

Referring to the use of static transformers as frequency changers, the author draws attention to the relations which hold between the various harmonics of the magnetising current

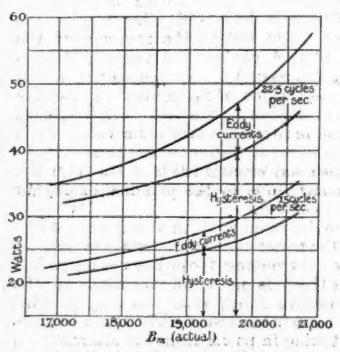

FIG. 5.—STALLOY CORE LOSSES.

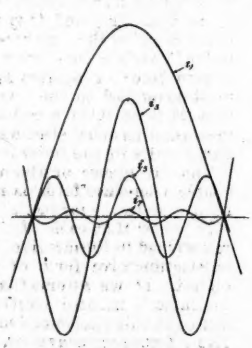

FIG. 6.—ANALYSIS OF MAGNETISING CURRENTS.

for flux densities in the Stalloy cores ranging from 17,000 lines per sq. cm. to 20,500 lines per sq. cm. (actual maximum values).

Fig. 6 shows the analysis of the current i into its harmonics, and may be taken as typical of all the current waves from the tests. It will be seen that the peak in the magnetising current is due to the approximate coincidence of the peaks of all the various harmonics.

In the above investigation the aim has been to obtain a flux in the Stalloy cores varying according to a simple harmonic law, this manner of variation being considered ideal. The deviation of the actual flux from the apparent flux is mainly due to the fifth-harmonic component of the flux. This harmonic would practically disappear if the fifth harmonic in the magnetising current could be short-circuited in a manner similar to that of the third harmonic, I_3, as in fig. 2 when the switch S is closed. This method being impossible with three-phase currents and three testers, the next best method, probably to insert condensers and variable inductances between the lines of the three-phase circuit and gradually to vary the inductances until resonance with the fifth harmonic is obtained. Considerable success has already been attained by shunting the fifth harmonic in this manner.

DISCUSSION.

Professor BAILY (Edinburgh) said that Mr. Nicholson's method was most ingenious—the method of using a three-phase system and using the mesh winding to emphasise the triple harmonic and star windings to stamp it out. Twenty years ago he had to use the calorimeter method. They did not in those early days trouble much about the triple harmonic, but what he had done was, as Mr. Nicholson had pointed out, to over-estimate the flux.

Mr. HIRD (Glasgow) thought the paper appeared more fitted for a society of pure physics than for that Institution. The theory of the paper, however, seemed to him to be a very reliable contribution to the science of the magnetisation of iron. As to the value of such an elaborate method purely from the testing point of view he had some doubt. When they measured the losses in the iron circuit of a dynamo where they had the dimmest notion as to what the flux would actually be, and what the respective densities were in each different part, the nearest approach such as they got in commercial testing was, he thought, quite as useful and as serviceable as the most elaborate methods which could be evolved.

Mr. W. W. LACKIE (Glasgow) said that the point in the paper about the third harmonic appearing in a star-connected transformer brought to his mind the case of a star-connected choke coil on a static balancer in connection with a continuous-current machine. The simplest form of this was two slip rings and a single choke coil, the middle-wire connection being taken from the middle of the choke coil. This did not give particularly good balancing, and the next step was to have four slip rings and two choke coils, the middle points of each being connected together and the middle-wire connection taken from this. It was suggested that the star-connected choke coil connected to three slip rings might be used, but he was informed by a manufacturer that this had been tried and they had been bothered with a third harmonic giving fluctuating pressure.

Mr. A. S. MACWHIRTER (Glasgow) said that the advantages of using a three-phase tester in preference to a single-phase tester were very striking, viz,, the elimination of the third harmonic in the star-connected windings, and the possibility of supplying the required triple harmonic component of the magnetising current in the mesh windings. There was also the advantage that the wattmeters connected as shown were measuring the power at a much higher power factor than would be possible with a single-phase tester and the likelihood of errors in the wattmeter readings was thus diminished.

Mr. A. L. TACKLEY (Glasgow) said the results of the paper showed that within the limits of maximum flux density 17,500-20,000 lines per cm² the shape of the magnetising current wave to provide a sine wave of flux reaching to high flux densities was approximately constant. He had mathematically worked out exactly the conditions necessary in order that the shape of the current wave might be truly constant.

Mr. B. PARKER HAIGH, in a written communication, stated that in the ordinary Epstein iron testing apparatus the wave of flux deviated very considerably from the sine wave, and the iron losses determined in this manner did not truly represent the losses for any particular flux density with simple harmonic variation. Mr. Nicholson had previously shown how several difficulties were overcome when the watts were measured by means of a secondary coil, wound within the primary coil of the Epstein apparatus, and it seemed regrettable that such a coil was not more generally employed. It was not easy to appreciate the advantage of using a sine wave flux, for by integrating the oscillogram of induced E.M.F., it was simple to ascertain the maximum value of the flux—upon which alone the hysteresis loss per cycle was believed to depend. But unless the wave form was constant, a difficulty existed in separating the eddy current and hysteresis losses, and it was there that improvement on ordinary methods was desirable.

Dr. ALEXANDER RUSSELL (Faraday House, London), in a written communication, said that Mr. Nicholson's researches proved that it was absolutely necessary to know the law according to which the magnetic flux density in the core of the sample under test varied. On the other hand, those who sent samples of iron to be tested usually specified that they wanted the watts lost per pound at a given maximum induction density and at a given frequency, the wave of potential difference applied to the magnetising coil being sine-shaped. From the oscillogram of the induced electromotive force in the secondary coil they could easily find the area A′ of the positive

(or negative) half of the E.M.F. wave. From this they found at once that the maximum value of the flux density in the core in this case Bm = 10^8 A′/ (2 n A) where n was the number of turns in the secondary coil and A was the cross sectional area of the iron. The value of B_m must be found in order to get the Steinmetz coefficient for the hysteresis loss. In order to calculate the eddy-current losses they found from the oscillogram of the E.M.F. wave, in the same way as shown in the paper, the values B_1, B_3, B_5 . . . for the harmonics of the flux density. Then, making the assumption that the amplitudes of these harmonics were approximately constant over the cross section of the iron strips, the eddy-current loss per cubic centimetre of the iron was given by

$$1{\cdot}64\ (t^2/\rho) f^2\ (B_1^2 + 9\ B_3^2 + 25\ B_5^2 + \ldots),$$

where t was the thickness of the strips in centimetres and ρ equalled the resistivity of the iron in C.G.S. units (about 10,000). As the wattmeter reading gave them the sum of the hysteresis and eddy-current losses they could, if they knew the Steinmetz index, easily find the Steinmetz coefficient. Mr. Nicholson's method of getting a sine-shaped flux, whilst most ingenious, was rather too complicated for every-day use.

Mr. D. J. MACKELLAR wrote asking Mr. Nicholson whether the magnetic leakage at the high flux densities employed had been found to have any appreciable effect on the flux distribution in the tester cores, and whether it could be reasonably assumed that the flux density was uniform over the whole tester.

Mr. A. M. TAYLOR (Birmingham), in a written communication, said that the information contained in the paper, had it appeared a year ago, would probably have saved mistakes in the design of a frequency-changer which proved expensive to rectify. He described his own large-scale experiments, and said that Mr. Nicholson's connections were virtually those of the Spinelli frequency changer.

Mr. NICHOLSON replied to some of the points raised, and deferred detailed reply to the report in the *Journal*.

BUSINESS NOTES.

Deed of Assignment.—L. FAWCETT, automobile and electrical engineer, Leeds.—Claims must be sent in by February 13th to the trustee, Mr. C. H. Baker, 1, Albion Street, Leeds.

Edinburgh.—THE NORTH BRITISH RUBBER CO., it is understood, have received large orders from the Admiralty and War Office which, along with their general business, necessitates a considerable addition to their factory.

Book Notices.—*High-Speed Telegraphy* is the title of a handsome brochure issued by Messrs. Creed, Bille & Co., Ltd., which describes the Creed system and its progress during the year ending June last. It has been adopted by a number of British Colonial and foreign Governments, cable companies, newspapers, and the British Post Office, and the makers claim that it has solved the problems of high-speed telegraphy. The Marconi Co. has adopted the system for its circuit between London and Towyn, in connection with the trans-Atlantic service, and it has been used largely by submarine cable companies for many years. Nothing could be more satisfactory than the enthusiastic letters from the proprietors of leading newspapers as to their experience with the Creed system. The apparatus, which was described in the ELECTRICAL REVIEW in 1907 and 1908, is now capable of working at a maximum line speed of about 200 words per minute, and instances are cited in which it has run for periods up to eight hours without stopping, at 140 words a minute. It is gratifying to note that, as the high-speed telegraph was developed in this country, so we still lead the world in this respect.

"Records of Railway Interests in the War." Part I. British, August-December, 1914. London: *The Railway News*. 1s.—This publication contains portraits of the heads of our great railway systems, and tells much concerning the all-important part that they have been, and are being, called upon to perform in the transport of troops. Most interesting and excellent pictures are given showing the equipment of trains for conveying the wounded.

The Engineering Standards Committee has issued an interim report on British Standard Sizes of Single-Row Ball Journal Bearings for Automobiles (C.L. 2,582). The Committee is also dealing with the question of specifying suitable tolerances to be allowed, and a complete report will be issued at a later date. The report can be had gratis on receipt of postage 1d. from the Committee, 28, Victoria Street, S.W.

"A.E.S.E. Progress" is the title of the official organ of the Association of Electrical Station Engineers, of which the first number, dated January 15th, has been received; it will be issued monthly to the members. In a foreword the hon. secretary, Mr. W. J. Ebben, who appears to be the editor, points out that while for the present the active efforts of the Association to remedy the troubles of its members have necessarily ceased, at the close of the war there will be more men than jobs available, and a strong organisation is necessary to prevent the reduction of salaries. The journal is, therefore, intended to maintain interest in the Association, and to increase the membership. The attitude of the I.E.E. towards the A.E.S.E. is discussed by J. W. Thomas, a couple of short stories follow, and about half the journal is devoted to Association affairs and correspondence. It is a neat and creditable production, and should prove a valuable aid to the Association's work.

"*Journal* of the Institution of Electrical Engineers," Vol. 53, No. 240; January 15th, 1915.—This issue contains papers on "Automatic Protective Switchgear for Alternating-Current Systems," by E. B. Wedmore, and "Coal and its Economical Use," by P. S. Thompson. There is also a "First List" of over 600 Members of the Institution who are serving with the Colours.

Calendars and Diaries.—MR. P. D. MORRIS, of 26, High Street, Islington, N., is sending out to his friends a refill pocket notebook on the multi-ring loose-leaf principle.

A celluloid pocket tablet from the KEY ENGINEERING CO., LTD., of Trafford Park, bears a calendar for 1915 with metric and English measures at opposite edges.

From the EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD., Ponder's End, we have received a neat metal stand containing a perpetual desk calendar. It is a handy little contrivance.

MESSRS. FLOWERDEW & CO., engineering translators, &c., of 14, Bell Yard, Temple Bar, London, W.C., have prepared a wall calendar with monthly slips for 1915.

Catalogues and Lists.—MESSRS. ALFRED HERBERT, LTD., Coventry.—Sixteen-page illustrated price list of Carpenter taps and dies.

ELECTRIC SUPPLIES MANUFACTURING CO., 24, Wilde Street, Liverpool.—Pamphlet giving illustrations and particulars of various designs of electric fires, and combined heaters and hot-plates.

ELECTRICAL APPARATUS CO., LTD., Vauxhall Works, South Lambeth Road, London, S.W.—New four-page leaflet (H 19 P/1) giving full description and tabulated prices of their D.C. motor control pillars.

MESSRS. MICKELWRIGHT, LTD., Alperton, Wembley.—Hanging card showing illustrations of the dimmers, rheostats, resistances and other lines which they manufacture.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich.—Sixteen-page illustrated pamphlet (No. A 710), containing descriptions of their various types of loud-speaking marine telephones.

MESSRS. BRUCE PEEBLES & CO., LTD., Edinburgh.—20-page pamphlet (No. 20 D) containing a full description of the Peebles motor-converter and a list of users, also a comparison of same with rotaries and motor-generators.

THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, E.C.—Leaflets dealing with the "Geekoduct" demon-grip continuity fittings, and electrical novelties in the shape of pocket lamps, torches and portable lamps and refills.

BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—New price leaflet No. 4,501—B giving particulars of B.T.H. lightning arresters for C.C. circuits; also descriptive list No. 3,120 (28 pages) containing full information relating to their A.C. switchboard panels for three-phase systems up to 6,600 volts, more than half of its pages being devoted to dimensional drawings and diagrams of connections.

Private Arrangements.—FELGATE INSTALLATION CO., LTD., Broadway Buildings, Station Road, Reading.—Pursuant to the provisions of the Companies' (Consolidation) Act, a meeting of the creditors of the above was held last week at the Reading Gas Co.'s Lecture Hall, Cross Street, Reading. It was stated that the company had passed the usual resolution in favour of voluntary liquidation, and had appointed Mr. A. G. West, C.A., of Market Place, Reading, to act as liquidator. According to the statement of affairs presented, the liabilities amounted to £2,115, of which £1,180 was due to the trade, and £426 to cash creditors, while there was an overdraft at the bank of £509. The assets were estimated to realise £674, and consisted of book debts £230, fixtures and fittings £70, stock as per balance-sheet of September 30th last £333, work in hand £31, rent receivable £5, and shares in an electrical company £5. No deficiency account had been prepared, but it was stated that the present position had been brought about through the war. A discussion took place as to the advisability of a joint liquidator being appointed, but eventually it was decided to confirm the voluntary liquidation, with Mr. West as the sole liquidator.

Liquidations.—THE HELSBY WIRELESS TELEGRAPH CO., LTD.—This company is winding up voluntarily, with Mr. J. B. Edwards, of 25, Victoria Street, S.W., as liquidator. A meeting of creditors is called for January 23rd.

THE ELECTRIC STORES, LTD.—A meeting of creditors was held on Friday last (January 15th), at 204, Wolverhampton Street, Dudley (Worcs.).

LEITNER ELECTRICAL CO., LTD., Maybury, Woking.—Mr. G. E. Corfield (with a committee of inspection) was appointed liquidator, December 23rd, 1914.

THE GENERAL ELECTROLYTIC PARENT CO., LTD.—Particulars of claims must be sent by February 10th to the liquidator, Mr. J. Barron, of Middlewich, Chester.

Australia.—A firm already representing several British manufacturers wishes to take up agencies for the whole of the Commonwealth for dynamos and motors, accessories, cables and flexible wire, insulators, &c. The name of the firm can be ascertained at the Board of Trade C.I. Branch in London, and communications should be addressed to H.M. Trade Commissioner for Australia, Commerce House, Melbourne.

For Sale.—The Stretford U.D.C. invites tenders for the purchase of two 100-KW. engine and dynamo sets, particulars of which are given in our advertisement pages to-day.

Trade Announcement.—MR. F. MARCHANT, electrician, has removed to 2, College Road, Bromley (Kent).

Bankruptcy Proceedings.—F. I. BEHRENS (F. Burns), electrical engineer, Barnsley.—Trustee (Mr. B. S. Briggs, Official Receiver, 21, King Street, Wakefield) released December 14th, 1914.

ALBERT WHITELEY, electrical and mechanical engineer, Llandudno.—Receiving order made January 14th, on debtor's own petition.

J. W. GARSDEN (J. W. Garsden & Co.), electrical engineer, Blackburn.—Debtor's discharge suspended for one month, on July 6th, 1914.

J. SWANISON (J. Swanison & Co.), electrical contractors, Manchester.—A first and final dividend of 10d. in the £, is payable on January 29th, at 27, Brazennose Street, Manchester.

LIGHTING and POWER NOTES.

Australia.—A scheme is being furthered by the N.S.W. Railway Department for the utilising of electric current in connection with the Sydney metropolitan tramway system, to provide illuminating power on several of the railway stations within the suburban section. At Petersham, Newtown, Ashfield, and other stations on the main suburban lines the fittings have already been put into position. The department, it is understood, also proposes at a later date to make use of electricity as an illuminant for the signal disks.—*Commonwealth Engineer.*

The Municipal Council of Manley, a suburb of Sydney, N.S.W., has decided to consider the question of resuming the Manley electricity works and running them for the benefit of the municipality.

The St. Leonards Council (Tas.) has decided to ascertain further particulars from the Launceston Council on the question of extending the electric light to St. Leonard's.—*Tenders.*

The result of the first year's working of the Port Melbourne municipal electricity undertaking with current supplied in bulk from the Melbourne City Council, shows receipts amounting to £2,512, and expenditure to £2,751. The number of private consumers is increasing every month, including several large industrial concerns attracted by the new tariff for power recently adopted.—*Melbourne Age.*

The Waverley Municipal Council has entered into an agreement with the Sydney Municipal Council for the supply of energy.

The Nunawding (Vic.) Council is floating a further loan of £5,000 for the extension of the electric lighting system, and a second scheme is to be undertaken as soon as the funds and equipment are available.

At Nuttagong (N.S.W.) a poll of the ratepayers resulted in favour of the proposed electricity supply and pumping scheme for the town. The scheme is estimated to cost £3,600.—*Tenders.*

Ballater.—E.L. SCHEME INAUGURATED.—On December 23rd last, the electric supply system at this Scotch holiday resort was inaugurated by Mr. Duncan, of Tillycorthie, who has taken a prominent part in the inception of the scheme. The cost of the installation, some £6,000 has been borne by Duncan's Electricity Supply Co., which is running the system for a period of years. The installation has been carried out by Messrs. T. C. Smith & Co., of Aberdeen, and includes at the generating station, two 68-B H P. Fielding & Platt suction gas engines driving 42-KW. B.E.P. dynamos, working in conjunction with a Chloride battery. There are about 100 street lamps, 40 of 50 C.P. and 60 of 25 C.P. each, and 120 private consumers, the total lamp connections being about 1,500. The Great North of Scotland Railway is understood to be going to wire its premises for 220 25-C.P. lamps. The distribution system is by means of overhead wires. Mr. Duncan, at a banquet held in honour of the event, expressed his regret that they should have had to use coal as fuel at their plant, owing to local opposition to the use of the ample water powers which were available in the neighbourhood. The charges for energy are 6d. per unit for lighting and 4d. per power.

Barnes.—The surveyor has informed the B.C. that in Limes Avenue where electric light is installed, the tenants wish to have gas stoves fixed, but the Gas Co.'s charges appear excessive. The electrical engineer was instructed to prepare a report and estimate for providing electric cookers.

Barnsley.—PROPOSED LOAN.—The T.C. has agreed to apply to the L.G.B. for sanction to borrow £4,800 for electric lighting purposes.

Bawnboy (Co. Cavan).—STREET LIGHTING.—The R.D.C. has accepted the Ballyconnell Electric Light and Power Co.'s tender for lighting the town.

Beccles.—PROV. ORDER.—The Public Lighting Committee of the T.C. has recommended that a prov. order be applied for, for street lighting by electricity and a special meeting of the Council is to consider the matter.

Bexley.—The West Kent Electric Co. has submitted to the U.D.C. a plan for an extension of the mains into Crayford parish, in order to supply the works of Messrs. Vickers. The proposed main will run from Eltham.

Bingley.—The U.D.C. has lodged an objection with the B. of T. against the proposed Keighley Corporation Electric Lighting Extension Order, so far as it affects East Morton, and a petition against the Yorkshire Electric Power Bill.

Bournemouth.—REDUCED TARIFF.—The Bournemouth and Poole Electricity Supply Co., Ltd., has reduced the price of current for lighting to 6d. per unit, as from the March quarterly readings of the meters.

Bury.—BULK SUPPLY.—The agreement by which the T.C. agrees to supply electricity in bulk to Heywood T.C. has now been completed.

Carlisle.—RESTRICTED HOUR TARIFF.—At a meeting of the T.C. on the 12th inst., a resolution passed by the Electricity Committee that in the case of bulk supplies of energy under agreement, on the restricted hour system, the fixed charges be reduced from £4 5s. to 15s. per KW. of demand per annum, was referred back. A long discussion took place, in the course of which it was urged that such action by the Electricity Committee would lead to corresponding reductions by the Gas Committee, and result in loss all round.

Chesterfield.—The T.C. has reduced the charge for current for lighting in the Whittington district from 4½d. to 3½d. per unit.

Chile.—A decree has been published approving the project presented by Don Federico Baechler for the installation of an electric lighting system in the town of Puente Alto, in the Department of La Victoria.

Colchester.—The T.C. has decided to augment the supply of current to the Lexden district by laying a further cable, at a cost of £235. This will enable the sub-station plant to be driven from the lighting mains instead of the tramway mains as at present.

Continental.—FRANCE.—In Paris, which has not yet been subjected to lighting restrictions to anything like the extent that London has, the military authorities have submitted proposals to the Government for diminishing the volume of outside and private lighting; this is also to apply to the suburbs of Paris, especially to the workshops where work is carried on night and day, and the light is visible from a distance.

Edinburgh.—PROV. ORDER.—The T.C. has approved of the Corporation Prov. Order, 1915, subject to a modification of one clause, in which the power to supply energy to lessees of new tramways has been abandoned.

At a recent meeting of the Merchants' Association, the T.C.'s proposal to trade in electrical fittings and open showrooms were keenly discussed, a deputation from the Contractors' Association attending. Mr. Stevenson, convener of the E.L. Committee, voiced the Corporation's views on the matter, pointing out that the proposal was not to sell anything or to do any wiring. He was convinced that there was a great future for hiring in the city, and that people would not hire from the individual trader.

Epsom.—SCHOOL LIGHTING.—The U.D.C. has entered into an agreement with the College authorities for a three years' supply of current, on the following scale:—Minimum of 3,000 units, 4d. per unit; 3,000 to 6,000, 3½d.; 6,000 to 9,000, 3d.; 9,000 to 12,000, 2½d.; as soon as the consumption arrives at a minimum of 12,000 units per annum, the charge to be on a flat rate of 3d.

Goring.—FAILURE OF SUPPLY.—Owing to a breakdown of the engines and to the water turbine becoming waterlogged the electric light supply has been stopped for more than a week.

Harrogate.—PROPOSED LOAN.—The T.C. has decided to apply to the L.G.B. for permission to borrow £500 for electric service mains and a similar amount for transformers.

Holme.—Regarding the Bill of the Yorkshire E.P. Co., the U.D.C. has asked for an undertaking that the Bill will not hinder the Council or a local company from running its own E.L. plant.

Holmfirth.—PROPOSED LOAN.—The U.D.C. has decided to apply to the L.G.B. for sanction to borrow £7,500 for carrying out the electricity scheme.

Langport.—PROV. ORDER.—The R.D.C. has decided to lodge objections against the prov. order for E.L. being applied for by Messrs. Christy Bros., the area of supply of which includes the parishes of Compton, Dundon and Somerton.

London.—ISLINGTON.—PLANT EXTENSIONS.—The B.C. is recommended to carry out extensions at the electricity works to meet the increasing demands for energy. The electrical engineer has prepared reports and estimates for additional plant, coal bunkers, &c., and Mr. Albion T. Snell, the Council's consulting engineer, is in agreement with the scheme, with slight alterations. The Lighting Committee recommends (1) the Council to apply for sanction to borrow £52,757, the estimated cost of the extensions; (2) that the Lighting Committee be authorised to proceed with the necessary works; and (3) that the amount of loan outstanding in respect of boilers to be displaced be repaid out of the reserve fund of the undertaking.

LAMBETH.—ELECTRICITY CHARGES.—At a meeting of the B.C. on Thursday last week, the Finance Committee reported that it had had under consideration the circular letter of the South London Electric Supply Corporation, Ltd., in which the company gave notice of its intention to increase the charge for the supply of electrical energy for lighting purposes from 4½d. to 5½d. per unit, but to grant a rebate of ½d. per unit in cases where the corporation's supply was used as the only illuminant upon the premises. Certain members of the Committee met directors of the corporation in reference to the increased charge, who stated that proceedings had been instituted in the High Courts in respect of the proposals, and it was then thought inadvisable to pursue the matter further. At the hearing before Mr. Justice Eve, the corporation admitted that in granting the rebate referred to, it was acting in breach of the provisions of the Electric Lighting Act, 1882, and it was willing to submit to a declaration to that effect, whereupon Mr. Justice Eve made the declaration. Mr. F. Kinnaird inquired if it was not a fact that the Council and other consumers were paying 5½d. per unit, whilst others were paying 5d. or less. Councillor Hunt said they were not aware of any such cases.

The Poplar, Shoreditch and Stoke Newington B.C.'s and the Loughton U.D.C. are to petition against the London and District E.S. Bill and the London E.S. No. 2 Bill.

SHOREDITCH.—The B.C., on the recommendation of the Electricity Committee, has decided to establish a municipal rifle range on ground belonging to the electricity department. The cost for providing and equipping the range with butts, targets, &c., is estimated at £100; wiring, £10; and rifles, £15.

ST. PANCRAS.—LOAN BALANCES.—The L.C.C. Finance Sub-Committee has again taken up with the B.C. the reductions of the outstanding periods of the 42-year loans on the electricity plant, pointing out that the Treasury had written stating its view that not only must renewals and replacements be provided otherwise than by loan, but that it was desirable to accelerate repayment of any balance outstanding in respect of plant retained for occasional use, or spare on the installation of new machinery. The B.C. asked for a copy of the correspondence with the Treasury, and decided to adjourn the matter pending its receipt. The question for the B.C. was whether the new plant could be considered as a "renewal or replacement," and it was decided that it undoubtedly could not be so considered. The Council has already agreed to write off unpaid balances on six engines at Regent's Park station, superseded by a 5,000-KW. turbine.

The B.C. has been recommended to petition against the London Electricity Supply and the Supply (No. 2) Bills.

Lurgan.—The Council has decided to apply for powers for the transfer of the undertaking of the Lurgan Gas Light and Chemical Co., also to make further and better provision with regard to the supply of water and electricity.

Luton.—PROPOSED PLANT EXTENSIONS.—The electrical engineer reports that the new plant now being installed at the electricity works together with the existing plant will be barely sufficient to supply the demands, and that it will be necessary to make arrangements, at an early date, for purchasing further plant, at an estimated cost of £27,000, exclusive of the cost of any additional mains which may be required.

Oakworth.—The U.D.C. is to oppose the proposed Bill of the Yorkshire Electric Power Co.

Penistone.—WORKHOUSE LIGHTING.—The B. of G. has referred to Messrs. C. Hodgkinson and J. M. Marston as experts a draft agreement with the Yorkshire E.P. Co. for the supply of current to the workhouse for lighting and power.

Penketh.—In connection with the proposed electric light prov. order for the district, the Warrington Electricity Committee has asked the P.C. for the approximate number of houses in, and population of the parish.

Penshurst.—The P.C., after discussing the Electricity Extension Bill of the Tunbridge Wells T.C., has decided to oppose the application so far as Penshurst is concerned. The R.D.C. has agreed to the P.C.'s action.

Penryn.—E.L. SCHEME.—Mr. Rickard, a resident of the town, has applied to the T.C. for permission to erect steel poles for overhead wires through the town for the purpose of electric lighting. The matter has been referred to a Committee for consideration.

Rawdon.—PUBLIC LIGHTING.—The D.C. has received a letter from the Yorkshire Electric Power Co. asking to be given an opportunity of quoting for public lighting, and has asked for a quotation for the lighting of the Leeds and Otley Roads.

St. Helier.—E.L. SCHEME.—Steps are being taken to provide a supply of electricity for the district. A company, for this purpose, has been registered, and it is hoped to have a supply of current available by the end of the year.

Selby.—E.L. SCHEME.—The R.D.C. has decided to assent to the application of the Yorkshire E.P. Co. for powers to extend the area of supply, so as to include the R.D.C.'s district.

Sevenoaks.—The U.D.C. has decided to give notice to petition against the London and District Electricity Supply Bill.

Southampton.—The Electricity Committee has decided to purchase an air filtering apparatus in connection with the turbo-alternator at the electricity works.

South Africa.—The Worcester (Cape Province) municipality is inviting applications for its local loan of £15,000 to cover the expenditure on the proposed electric lighting scheme. Both the scheme and the loan are very popular.

The Cape Town City Council has decided to make a charge for connections to the electric light supply of £3 for the first 100 ft. plus the actual cost of labour and material required in providing any additional length. For several years it has been the custom to make free connections within 100 ft. of the supply mains. The cost of connection may if desired (in cases where within 100 ft.) be paid for in 12 monthly instalments of 5s.

Surrey.—The C.C. has decided to seek protective clauses in the prov. orders for E.L. being applied for by Mr. Gilbert Allom, for the parishes of Chipstead, Coulsdon, Woodmansterne, Banstead, Kingswood, and Walton-on-the-Hill.

Truro.—PROPOSED LOAN.—The T.C. has received the consent of the B. of T. to the proposed site for the generating station, and has decided to apply to the L.G.B. for a loan of £10,000 for carrying out the E.L. scheme. The period for which the order was granted expires next August.

Walsall.—PUBLIC LIGHTING.—The T.C. has adopted the recommendation of the General Purposes Committee to light a new thoroughfare with eight electric standards, each carrying three 50-C.P. metal lamps, at an inclusive contract rate of £2 14s. 6d. per annum. The gas department offered 320 C.P. per lamp, at £2 15s. per annum. A long discussion occurred in the Council, where it was pointed out that the desire was to obtain the best form of lighting, not necessarily the cheapest. Up to the present the electricity department's share in the street lighting has been 19 arc lamps, which are being converted to half-watt lamps, while the gas department has about 1,400 lamps, and, judging by the remarks made, the local gas lighting would appear to be so defective as to give no guarantee that the suggested 320 C.P. would be obtained. One speaker aptly remarked: "Eternal vigilance is the price of decent gaslight."

Wells.—PROV. ORDER.—The T.C. is recommended to oppose the application of Messrs. Christy Bros. for a prov. order. One of the grounds of opposition is that the proposed area of supply is too restricted.

West Ham.—ELECTRIC COOKING.—The Education Committee has been recommended to install electric grillers at the Rosetta Road School.

Woodford.—The U.D.C. has decided to withhold consent from the prov. order for E.L. being applied for by the County of London Electric Supply Co. Wanstead U.D.C. is also opposing it.

Whitstable.—The U.D.C. has decided to have the E.L. installed throughout the Council's offices. A specification is to be prepared, and tenders will be limited to local firms.

Windsor.—RESTRICTED LIGHTING.—On account of the restricted lighting order, the Windsor Electrical Installation Co. has reduced the Corporation's lighting account for the past quarter by £17.

Yorkshire Power Co.'s Bill.—At a conference of West Riding boroughs, held at Leeds, it was decided to oppose the Yorkshire Electric Power Co.'s proposed Bill.

TRAMWAY and RAILWAY NOTES.

Argentina.—BUENOS AIRES UNDERGROUND RAILWAY.—The Compagnie Générale de Tramways de Buenos Aires of Brussels reports that the first section of the underground railway of the Anglo-Argentine Tramways Co. in Buenos Aires was opened for traffic in December, 1913, the length being 4·2 miles. During the first nine months of working the average receipts, if applied to a whole year, would amount to £46,000 per km. per annum, as compared with £31,200 in Paris, £22,400 in London, and £47,200 per km. in New York. As a consequence of the financial crisis in Argentina the construction of the second underground section has been indefinitely postponed, although the hope is expressed that an extension of time will be granted by the authorities. The European war has reacted unfavourably on Argentina and a reduction in the working results of the tramways is held in prospect.

Australia.—The new tramway from Camberwell to Melbourne, *via* Richmond, is expected to be open for traffic next September. The work of construction is proceeding rapidly; tenders for the supply of rails have been received, and wherever possible substantial preference will be given to Australian manufactures and material in connection with the works.

The Fitzroy and Northcote (Vic.) municipalities have agreed to the construction of an electric tramway to connect with Preston.

Belfast.—NINE MONTHS' WORKING.—The report of the tramway working for the nine months ended December 31st shows a balance on net revenue account, after allowing for all fixed charges, of £20,133.

Bingley.—The U.D.C. proposes to apply to the B. of T. for a further extension of time for the construction of the tramway round Rishworth Hall corner.

Bury.—The Chamber of Commerce has decided to forward the following resolution to the Associated Chambers of Commerce:—"That in the opinion of this Association considerable commercial advantage would accrue through the utilisation of municipal tramways for the transit of goods, and recommends individual Chambers to exercise their influence to further this use."

Chile.—The German Electric Tramways Co. in Santiago de Chile has suspended operations owing to a disagreement with the local authorities, who have prevented it from charging double fares.

Dundee.—The Corporation Tramways Committee has sanctioned the expenditure of £1,565 on the laying of larger cables in certain roads, where the existing cables are said to have led to breakdowns

Fife.—The Dunfermline and Kirkcaldy District Committees of the County Council have decided not to oppose the Dunfermline and District Tramways Order.

Glasgow.—Opposition is to be offered by the T.C. to the proposed Caledonian Railway prov. order, which, among other matters, seeks powers to provide and work road vehicles. Correspondence has taken place with regard to the powers sought, and it has been reported to the Parliamentary Bills Committee of the T.C. that these, if passed, would adversely affect the tramway department, and are wider than those obtained in recent years by other railway companies, and that the Municipal Tramways Association, with the secretary of which the manager has been in communication, has on several occasions successfully opposed similar clauses.

Hindley.—RUNNING POWERS.—The U.D.C. has decided to allow the Wigan Corporation to run its cars over the lines leased by the Council to the South Lancashire Tramways Co., and to assist the Corporation to obtain the best possible terms. Such running is to cease unless the Corporation undertakes within three years to construct a new line from the terminus of the existing line to the Hindley boundary.

Hyde.—With a view to obtaining clauses for the protection of the borough, the T.C. is to petition against the proposed Bill of the Joint Tramways and Electricity Board, which provides for extension of tramways.

Mossley.—The T.C. has decided to recommend the Stalybridge Joint Board to include in its proposed Bill a clause to provide for the running of motor-'buses along Lees Road to connect with the tramways at Springhead.

Preston.—ANNUAL REPORT.—The receipts for the year ended March 31st last of the Corporation tramways were £45,946, an increase of £2,675; the gross balance fell from £9,023 to £6,340, owing chiefly to increased working expenses. Out of the net sum available £1,300 was contributed to the rates, leaving £2,551 to go to the reserve fund, instead of £5,374.

Southampton.—SIX MONTHS' WORKING.—Receipts on the tramways for the six months ending September last amount to £37,000, an increase of £702 as compared with the same period 12 months previously. To get this increase an extra mileage of 128,841 was run, and an extra 148,252 passengers carried, whilst the energy consumed shows an increase of 34,287 units. The receipts per car-mile showed a decrease of 1·385d. for the period under review.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The Government is making arrangements to equip the trans-Continental railway works with four wireless plants, so as to enable the working parties to keep in touch with each other, and thus avoid delays in the exchange of instructions. The sets have been designed by the Commonwealth engineer for radiotelegraphy (Mr. Balsillie). Each will have a range of about 150 miles, but will rarely be required to work over 20 to 30 miles. They will be used chiefly at the head railway works. There is to be a truck fitted with wireless plant at the railhead on the Western Australian end of the line and another at the South Australian end. Several water-boring parties and other gangs of workmen are ahead of these points preparing the way for the construction of the earth works and the laying of the rails. Two wireless plants carried in motor-cars are to accompany these parties.—*The Age.*

Japan.—A Bill has been introduced in the Japanese Diet to provide a sum of £115,000 for a new submarine telegraph cable between Nagasaki, Japan and Tamsui, on the Island of Formosa. The new Budget also includes a sum of £1,500,000 for the extension of the telephone system in Japan.

The Telephone Service.—Several new exchanges in London are approaching completion, and an underground cable, costing over £100,000, is being laid between London and Brighton, which will provide junction lines sufficient to give a direct service without the formality and loss of time incurred by giving a trunk call. The improved service will also be extended to towns in the South of England as far as Bognor and Chichester.

United States.—The Compagnie Universelle de Télégraphie et de Téléphonie sans Fil has filed a petition in the New Jersey Courts against the German owners of the Tuckerton wireless station, claiming that an agreement was entered into whereby the property and patents of the defendants were to be turned over to the French firm in all countries except Germany. The German company failed to complete the agreement on account of the war. The wireless station is at present controlled by the United States Naval authorities.

CONTRACTS OPEN and CLOSED.

OPEN.

Aylesbury.—February 6th. U.D.C. Supply of electric motors to consumers (hire-purchase agreement). See "Official Notices" to-day.

Australia. — ADELAIDE. — February 10th. Testing instruments, for Postmaster-General. See "Official Notices" January 1st.

BRISBANE.—March 10th. Motor-generator, power board, &c., for Postmaster-General. See "Official Notices" January 15th.

BRISBANE.—(Extension of time to March 16th.) Common battery multiple switchboard and automatic or semi-automatic switchboard, &c., for the Deputy P.M.G.—*Board of Trade Journal.*

PERTH.—February 10th. Telephone switchboards and parts, for Postmaster-General. See "Official Notices" January 8th.

Melbourne, Brunswick and Coburg Tramways Trust.—February 24th. Special work, bonds, steel and wood poles, overhead materials, H.T. cable, trucks, and sub-station electrical equipment. March 10th. Car equipments (motors, &c.), car bodies, wheel guards. Specifications for each item, £2 2s. (returnable), from the office of the Engineer (Mr. Struan Robertson), Sydney Road, Coburg. Copies can be seen at the Board of Trade Commercial Intelligence Department in London.

Beckenham.—January 25th. U.D.C. One 120-KW. D.C. generator and switchgear to couple to 120-KW. steam alternator. See "Official Notices" January 8th.

Bolton. — February 11th. Corporation. Low-tension sub-station switchgear, for the Electricity Department. See "Official Notices" January 8th.

Bury.—January 30th. Extension to reinforced concrete retaining wall at the electricity generating station, Chamber Hall. Specifications, &c., from Mr. J. A. Settle, Borough Engineer.

Cardiff.—February 22nd. Installation, 750 points, at New Technical Institute, Cathay's Park, for the City Council. See "Official Notices" to-day.

Cheltenham. — January 30th. Corporation. Twelve months' supply of electric light fittings, &c. Forms of tender from Mr. J. S. Pickering, Borough Engineer.

Colchester. — February 6th. Corporation. Twelve months' supply of stores, including lighting fittings, car equipment, overhead equipment, cable, &c. See "Official Notices" to-day.

Croydon. — January 25th. General stores, for the Corporation Tramways Department, for a year. The Manager, Thornton Heath.

Darlington.—February 2nd. Corporation. Alternative tenders for 2,000-KW. and 3,000-KW. turbo-alternators; separate tenders for condensing plant. See "Official Notices" January 15th.

Dundee.—February 1st. Corporation. Supply of 15-ton overhead travelling crane for Walton electric sub-station. Specification from Mr. H. Richardson, Engineer, Electricity Department.

Halifax.—February 15th. Corporation. Twelve months' supply of stores, including lighting fittings and electrical accessories, cables, telephone wire, meters, &c. See "Official Notices" to-day.

Hong Kong.—February 3rd. No. 5, steel structural work; No. 6, coal-handling plant. Specifications, &c., £1 each (returnable), from Messrs. Preece, Cardew & Snell.

Larne.—January 29th. For lighting public streets and roads by electricity for three years from August 1st, by the U.D.C. Particulars from Mr. W. G. Younge, Clerk to the Council.

Leeds.—February 20th. Corporation. Twelve months' supply of stores, including cable, mains boxes and fittings, jointing and insulating material, electric lamps, fittings, &c., for Electric Lighting Department. See "Official Notices" to-day.

London.—L.C.C.—January 26th. Platelaying, &c., for electric tramway, Grove Road and Burdett Road, &c. Specifications, &c., from Mr. G. W. Humphreys, County Hall, Spring Gardens, S.W.

January 25th. Lighting installation (200 wiring points, 260 lighting points) at Exmouth Street Elementary School, Hampstead Road, N.W. See "Official Notices" January 15th.

January 26th. 10,000 or 5,000 driving and pony wheel tramcar tires. Specification, &c., from Chief Officer, L.C.C. Tramways, 62, Finsbury Pavement, E.C.

BERMONDSEY.—February 5th. B.C. Twelve months' supply of carbons and brushes, cable and jointing material, stoneware conduits, meters, demand indicators, main fuses, oils, meter boards, street frames, covers and joint-boxes. See "Official Notices" to-day.

Middleton.—Tenders are invited for coal required at the Corporation electricity works. Mr. Pauls, Electrical Engineer.

Newcastle-under-Lyme.—February 5th. Three-wire single, L.T. paper, lead-covered cable, armoured feeder and distributor mains, for the Electricity Department. See "Official Notices" to-day.

New Zealand.—WELLINGTON.—February 28th. Public Works Department. 18 step-down transformers, for the Lake Coleridge power scheme. Specification at the Public Offices, Wellington.

Portsmouth.—February 3rd. Corporation. Twelve months' supply of stoneware pipes, castings, street work, &c., for the Electricity Department. Forms of tender from the Electricity Station, Gun Wharf Road.

Redditch.—U.D.C. Two turbo-alternators, each 1,000 KW., with condensers, cooling tower, &c.; two synchronous motor-alternators of 300 KW. and 150 KW. respectively. See "Official Notices" January 8th.

Rochdale.—January 27th. Tramways Committee. Erection and completion of repair shops: (*a*) reinforced concrete foundations and car platform, (*b*) steelwork (steel frame), and (*c*) builders' work. Particulars from Mr. P. W. Hathaway, Town Hall.

Sheffield.—January 25th. Corporation Tramways. Tie-bars. Specifications, &c., 10s. (returnable), from Mr. W. J. Hadfield, Surveyor, Town Hall.

Tunbridge Wells.—January 26th. Cooling tower and pipework, two water-tube boilers, economisers, mechanical stokers, pipework, and feed heater, for Borough Electricity Works. See "Official Notices" January 1st.

Warrington.—January 29th. County Borough Education Committee. Electric lighting and bell installation at Oakwood Avenue Council School. See "Official Notices" to-day.

Wigan.—January 26th. Forty tons of street tramway rails, B.S.S. No. 3, and 200 cranked tie-bars. Mr. A. J. Gooseman, Borough Engineer.

Woodstock.—February 4th. Generating plant, switchboard, battery, wiring, lamps and fittings (120 points), for the Union Workhouse Guardians. See "Official Notices" January 15th.

CLOSED.

Ayr.—In connection with the new enteric fever block at Heathfield Hospital, the tender of Messrs. Reid & Co., Ayr, at £145, has been accepted for electric light installation work.

Heywood.—The T.C. has accepted the tender of Messrs. James Mills & Co. for electric motor and gas engine at Botany Bay sewage works.

Glasgow.—The T.C. Tramways Committee on Works and Stores has recommended acceptance of the following:—

Section pillar switches.—B.I. and Helsby Cables, Ltd.
Insulators for same.—Taylor, Tunnicliff & Co., Ltd.
·6 sq. in. V.I.R. cable.—B.I. and Helsby Cables, Ltd.
Conduit for Millerston Extension.—Albion Clay Co., Ltd.
Motor spirit.—James Ross & Co.; Oakbank Oil Co., Ltd.; Young's Paraffin Light and Mineral Oil Co., Ltd.: Broxburn Oil Co., Ltd.
Benzole.—Brotherton & Co., Ltd.

The T.C. Committee on Electricity received tenders for the supply of rotary converters to be put down in the Fairfield Engineering Works, Govan, and agreed to recommend acceptance of an offer by Messrs. Dick, Kerr & Co. for three 1,000-KW. sets and two 100-KW. sets, at £7,816, it being the lowest.

Hornsey.—The Council has accepted the following tenders:—

E.H.T. switchgear.—A. Reyrolle & Co., Ltd., £1,148. Eight firms and companies tendered.
L.T. generator and feeder switchboard.—Electric Construction Co., Ltd., £633. Nine firms and companies tendered.
E.H.T. cable.—Western Electric Co., Ltd., £1,093. Nine firms and companies tendered.

Chairman Morits said that the tender for cable from a German firm was not given any consideration.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named:—

WAR OFFICE.

Asbestos-cement sheet.—Bell's United Asbestos Co., Ltd.
Electric drills.—S. Wolf & Co., Ltd.
Electric lighting sets.—Austin Motors Co., Ltd.
Electric lamps.—Brimsdown Lamp Works, Ltd.; Crysalco, Ltd.; Dick, Kerr & Co., Ltd.; Omega Electric Lamp Co., Ltd.; Pope's Electric Lamp Co., Ltd.; Rugby Lamp Co.; "Z" Electric Lamp Mfg. Co., Ltd.
Telegraph equipment (leather goods).—J. Angus & Co.; Beckworths, Ltd.; G. G. Bussey & Co., Ltd.; Hathaway, Son & Co.; Hepburn, Gale and Ross, Ltd.; J. A. Jacobs & Co., Ltd.; T. Keave Lycett Saddle and Motor Accessories Co., Ltd.; McKinstry & Co.; Manufactures, Ltd.; Martins, Birmingham, Ltd.; Philpot & Sons; J. A. Pritchard; R. W. Stiby.
Wiring for electric lighting.—At Aghada Camp, Craig & Paton, Ltd.; Ballykinter Camp, W. Coates & Son, Ltd.; Clandeboye Camp, Craig and Paton, Ltd.; Curragh Camp, Maguire & Gatchell, Ltd.; Randalstown Camp, J. Robinson & Co.; Tipperary Camp, W. Coates & Son, Ltd.

CROWN AGENTS FOR THE COLONIES.

Cables and boxes.—British Insulated and Helsby Cables, Ltd.
Electric cranes.—Ransomes & Rapier, Ltd.
Electro-pneumatic hammer.—B. & S. Massey, Ltd.
Telegraph poles.—Bullers, Ltd.
Wireless telegraph apparatus.—Marconi's Wireless Telegraph Co.

INDIA OFFICE, STORE DEPARTMENT.

Cells.—Siemens Bros. & Co.
Dynamos.—J. Stone & Co.
Cable.—Siemens Bros. & Co., Ltd.
Motors.—Lancashire Dynamo Co.

POST OFFICE.

Laying lines of stoneware ducts.—At Ware (Watton Road), J. Mowlem and Co., Ltd.; Sheffield-Doncaster, Section 1, R. & T. Howarth; Section 2, J. W. Pearce.
Laying lines of cast-iron pipes, U troughing (with cable), and stoneware ducts.—At Hove, J. Mowlem & Co., Ltd.; at Sidcup, F. G. Brummell.
Laying lines of cast-iron pipes and stoneware ducts.—East Barking Cemetery, F. G. Brummell; at Inverness Terrace, Bayswater Road, J. Mowlem & Co., Ltd.; at Waterloo, Liverpool, W. Pollitt & Co., Ltd.
Laying lines of cast and wrought-iron pipes and stoneware ducts.—Lower Clapton, N.E., G. J. Anderson; at Inverness, H. MacVinish; at Waltham Cross, W. Griffiths & Co., Ltd.
Laying lines of cast-iron pipes, steel tubes and stoneware ducts.—Finchley Road, N.W., D. R. Paterson, Ltd.; at Barking-Grays, J. Mowlem and Co.
Laying lines of stoneware ducts.—Victoria Street, Parliament Street, S.W., J. Mowlem & Co., Ltd.; Museum Exchange-Gray's Inn Road, O. C. Summers.
Laying lines of underground conduits.—At Shoreditch, Stepney, &c., O. C. Summers; at Fulham, &c., O. C. Summers; at Paddington and St. Marylebone, O. C. Summers; at Kensington, O. C. Summers; at St. Pancras, D. R. Paterson, Ltd.; at Hendon, Finchley, &c., O. C. Summers; at Camberwell, S.E., O. C. Summers; at Hammersmith, F. G. Brummell.
Manufacturing, supplying, drawing-in and jointing paper-core lead-covered cables.—London-Colchester, Siemens Bros. & Co., Ltd.; Sheffield-Doncaster, Johnson & Phillips, Ltd.
Supplying and installing two motor-generators, controlling switchboard, cable, wire, &c., at the G.P.O. (West), E.C.—Mawdsleys, Ltd.
Installing electric lighting and power supply cable at Birmingham H.P.O. Extension.—G. E. Taylor & Co.
Installing electric light at Dublin P.O.—Grindlay, Ross & Co.
Telephone exchange extension equipment.—At Putney, S.W., Western Electric Co., Ltd.; at Brixton, S.W., Western Electric Co.; at Sevenoaks, Western Electric Co.
Protective apparatus.—British L. M. Ericsson Mfg. Co., Ltd.
Telegraphic apparatus.—Siemens Bros. & Co., Ltd.
Telephonic apparatus.—Automatic Telephone Mfg. Co.; British L. M. Ericsson Mfg. Co., Ltd.; Peel-Conner Telephone Works, Ltd.; Western Electric Co.
Submarine cable.—India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.; Telegraph Construction and Maintenance Co., Ltd.
Dry cells.—Siemens Bros. & Co., Ltd.
Porous cells.—British Insulated and Helsby Cables, Ltd.; Siemens Bros. and Co., Ltd.
Cable distribution plugs.—Siemens Bros. & Co., Ltd.
Solder.—B.I. and Helsby Cables, Ltd.
Cable suspenders.—P. Huntington & Co.
Battery zincs.—Eyre Smelting Co.; Siemens Bros. & Co., Ltd.
Jointing bronze sleeves.—Dugard Bros.

London.—STEPNEY.—Lest any reader should imagine that the British Central Electrical Co., Ltd., is a French concern, we are asked to state that the word "France" appearing after the name of the company, on page 51 of our issue of January 8th, was merely intended to indicate that France was the country of origin of the carbons for which it quoted.

ISLINGTON.—Last month we reported the decision of the Lighting Committee to continue the existing contracts for the supply of goods and materials to the Electricity Department for a further period of 12 months, provided the contractors concerned gave their consent. The following firms have agreed to the Committee's proposal:—

Chamberlain & Hookham.—Electrical sundries.
I.R., G.P. & Telegraph Works Co.—Ditto.
Crysalco Co.—Ditto.
B.I. & Helsby Cables.—High and low-tension cables.
W. Lucy & Co.—Service and network boxes, &c., castings.
J. Gibb & Co., Ltd.—Ditto.
Dussek Bitumen Co., Ltd.—Box compound and bitumen.
British Electric Transformer Co., Ltd.—Transformers and accessories.
Dick's Asbestos Co., Ltd.—Engine room stores.
J. Gibb & Co., Ltd.—Ditto.
A. Round.—Electrical sundries.
Vacuum Oil Co.—Oil and lubricants.
First Anglo-Russian Oil Co.—Ditto.
J. Knowles & Co.—Earthenware pipes, &c.
Turner & Lisney, Ltd.—Ditto.
Doulton & Co., Ltd.—Ditto.

The under-mentioned contractors are prepared to continue their contracts, subject to an increase in price:—

General Electric Co.—Conduit steel and opal globes.
Heap & Johnson.—Rectifier and collector ring brushes.
Young & Sons.—Insulators, troughs, fire-bricks, &c.
Leeds Fireclay Co.—Ditto.
B.I. & Helsby Cables.—Service and network boxes.
Callender's Cable Co.—Ditto.
Johnson & Phillips.—Transformers and accessories.

In some cases contractors have expressed their unwillingness to continue their contracts, and the Committee proposes to purchase the goods or materials as and when required in the most favourable market. The Committee has decided to accept the offers of the above-mentioned contractors.

Newport (Mon.).—The T.C. has accepted the tender of Messrs. Babcock & Wilcox, at £150, for a steam feed water heater and accessories.

Southampton.—The following tenders have been accepted by the Town Council:—

John Brown & Co.—48 steel tramway tires, at £15 10s. per ton.
B.I. and Helsby Cables, Ltd.—Three miles of tramway trolley wire, at 8½d. per lb.

Sunderland.—The T.C. has accepted the following tenders:—

S. Z. de Ferranti, Ltd.—Meters.
B.I. and Helsby Cables.—Trifurcating boxes.

Watford.—The B. of G. has accepted the tender of Messrs. Rogers & Gowlett, Ltd., for the electric light installation at the new nursery block at the workhouse, at £33.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, January 22nd. At 8 p.m. At 39, Victoria Street. Paper on "Rotary Air Pumps," by Mr. A. Arnold.

Friday, January 29th. At 8 p.m. At 39, Victoria Street. Debate on "London's Future Electricity Supply," opened by Mr. P. C. Batstone.

(Sheffield and District Branch).—Friday, January 29th. At 8 p.m. At Cutler's Hall, Sheffield. Ordinary Meeting.

(Midland Section).—Saturday, January 30th. Social Evening.

Institution of Mechanical Engineers.—Friday, January 22nd. At 8 p.m. At Storey's Gate, S.W. Paper on "Standardisation of Pipe Flanges and Flanged Fittings," by Mr. J. Dewrance.

Physical Society of London.—Friday, January 22nd. At 5 p.m. At Imperial College of Science, South Kensington. Paper on "Practical Harmonic Analysis," by Dr. A. Russell.

Royal Institution of Great Britain.—Saturday, January 23rd. At 3 p.m. At Albemarle Street, W. Lecture I on "Aerial Navigation—Scientific Principles," by Dr. R. T. Glazebrook, F.R.S. January 30th. Lecture II.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, January 23rd. At 4.30 p.m. At Royal Technical College, Glasgow. Joint Meeting with National Association of Colliery Managers. Paper on "Electricity at the Coal Face," by Mr. J. Bowman. After the meeting several Visual Signal Indicators will be exhibited.

(Notts. and Derby Branch).—Saturday, January 23rd. At 3.30 p.m. At University College, Nottingham. Ordinary meeting.

(Lancashire, Cheshire and North Staffordshire Branch).—Saturday, January 30th. At 6.30 p.m. At Grosvenor Hotel, Deansgate, Manchester. Presidential Address by Mr. B. Shaw, and paper on "Prevention of Electrical Accidents in Mines," by Mr. T. J. Nelson.

Association of Engineers-in-Charge.—Saturday, January 23rd. At 3 p.m. Visit to Messrs. D. Napier & Sons' Works, Acton Vale, W.

Saturday, January 30th. At 7.30 p.m. At St. Bride's Institute, Bride Lane, E.C. Discussion on "English *v.* German Superiority of Business Methods."

Royal Society of Arts.—Monday, January 25th. At 8 p.m. At John Street, Adelphi, W.C. Cantor Lecture (II) on "Oils, their Production and Manufacture," by Dr. F. Mollwo Perkin.

Institution of Civil Engineers.—Tuesday, January 26th. At 8 p.m. At Great George Street, S.W. Discussion on "The Lateral Pressure and Resistance of Clay, and the Supporting Power of Clay Foundations," opened by Mr. A. L. Bell.

Wireless Society of London.—Tuesday, January 26th. At 8 p.m. At the Institution of Electrical Engineers. Presidential address, by Mr. A. A. Campbell Swinton on "Some Electrical Phenomena—Illustrated by Experiments." Members of the I.E.E. of all classes are invited to attend.

Institution of Electrical Engineers.—Thursday, January 28th. At 8 p.m. At Victoria Embankment, W.C. Sixth Kelvin Lecture on "Lord Kelvin's Work on Gyrostatics," by Prof. A. Gray, F.R.S.

(Manchester Local Section).—Tuesday, January 26th. At 7.30 p.m. At Engineers' Club, 17, Albert Square. Paper on "Electric Steel-Making Furnaces," by Mr. T. D. Robertson.

(Birmingham Local Section).—Friday, January 29th. At 7.30 p.m. At University, Edmund Street. Lecture on "Kelvin's Work on Gyrostatics," by Prof. A. Gray, F.R.S.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, January 29th. At 7.30 p.m. At Bolbec Hall, Newcastle. Ordinary Meeting.

(Graduates' Section).—Saturday, January 30th. At 7.15 p.m. At Bolbec Hall. Paper on "Some Notes on Ship Resistance," by Mr. A. P. Patterson.

NOTES.

Educational.—On Monday the Manchester Educational Authority opened a new junior day technical school for boys between the ages of 13 and 16 who desire to enter the electrical engineering, building, or allied trades. The school, which is at Newton Heath, is a new feature in local education, and about 40 students have passed the entrance examination. A second school is to be opened in Openshaw, another industrial district, at Easter.

Singular Electric Blasting Accident.—An accident unique in the history of electric blasting occurred on the Rand on December 12th at the City Deep circular shaft, resulting in the deaths of two white men and two natives, and the severe injury of a third native, whilst two other natives were badly shaken. The European victims were Messrs. R. Kenny, leading sinker, and J. Lawson, his helper. They were leaving the bottom of the shaft at 6.30 a.m., after having connected up the round of holes ready for blasting, and the sinking bucket in which they were being hoisted had reached a spot about 20 ft. from the bottom when the whole round of holes went off. The force of the explosion blew the bucket and its occupants on to the platform about 50 ft. above them. In the ordinary way the men would have been hoisted to the surface, and, after the usual precautions to ascertain that all the men had left the shaft, the connected holes would have been fired by the switch on the surface. The accepted explanation of the terrible accident is that a fierce flash of lightning during a thunderstorm, which was raging at the time, struck the ropes of the skip or the guide ropes, and that these acted as a conductor connecting with the cable or the wires at the bottom of the shaft. This shaft is known as No. 3, the big circular ventilating shaft, and is now nearing completion. It may be remembered that in the discussion that took place some time ago on the subject of electric blasting on the Rand the possibility of accident from this cause was pointed out.—*South African Mining Journal.*

In a letter to the editor of the *Journal*, "A. J. K." says:—The defunct J. Lawson mentioned at the accident at the City Deep was (I am almost sure) a miner at Jagersfontein at the time (October, November, December, 1900,) Jagersfontein was in a state of siege. Mines were set at certain strategic points, to be blasted on emergency by electricity. The insulated wire that should have been used for the connections was not then procurable. On four separate occasions, with my own eyes I saw four of these mines exploded. The flash most probably did not strike directly on the wires, but certainly may—or did—have set up some sympathetic current in the earth itself. But the flash certainly caused the explosions. J. Lawson must have known this. On the other hand, he was at the bottom of a shaft, of which the depth is not recorded. In such weather as has been obtaining of late, those wires should not have been allowed to protrude at the surface. Either they should have been stationed some 20 to 30 ft. from the surface, or the miner should have unwound them off a reel in the act of ascending—or, failing these precautions, he should have been warned from the surface that thunder conditions existed. Lawson, with his experience, would never have been killed from a cause of which he well knew the danger.

Institution and Lecture Notes.—Institution of Electrical Engineers (YORKSHIRE LOCAL SECTION).—At the meeting on Wednesday last week, Mr. E. B. Wedmore read his paper on "Automatic Protective Switchgear for Alternating Current Systems." The discussion was closed.

Swansea and District Institute of Engineers.—A paper entitled "Invisible Light Waves" was to be read by Mr. A. L. Stanton, yesterday, in which X-ray equipments and their operation were specially treated with a view to assisting members of the medical profession.

Electrical Association of N.S.W.—The last meeting of the Electrical Association of New South Wales was held in Sydney on November 13th. The Association will in future be known as the N.S.W. Section of the Electrical Association of Australia. The annual report, referring to the licensing of wiremen, stated that rules had been drafted for the purpose, and it was expected that they would come into operation at the beginning of the new year. The Council placed on record the continued and valuable services given to the Association by the hon. secretary (Mr. F. W. McAlister) and the hon. treasurer (Mr. G. R. Hodson). The balance-sheet showed a credit balance of £156.

Mr. W. H. Myers, who has been elected first President of the N.S.W. Section, has been a strong advocate of the federation of the electrical associations throughout the Commonwealth, and the basis upon which the amalgamation was arranged was largely along the lines of the scheme put forward by him. Mr. Myers is an assistant engineer in the N.S.W. Government tramways department.

Mr. R. Vine Hall, mains superintendent of the Sydney City Council, has been awarded the N.S.W. Electrical Association's Rooke premium for the best paper read during the session just concluded, the subject being "Distribution of Energy by Overhead Mains."—*Commonwealth Engineer.*

Mr. Donald S. Munro delivered a lecture on "Modern Electrical Wiring," on Saturday last, to the Scientific Society of the Royal Technical College, Edinburgh. Examples of a new method of wiring devised by Mr. Munro were exhibited.

Mr. Bernard Price has been elected President of the SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS for the year 1915.—*South African Mining Journal.*

Disinfection by Electrolysis.—According to the *Hospital* very satisfactory results have been obtained at Bexley Mental Hospital with hypochlorite of soda produced by the electrolysis of a 4 per cent. solution of common salt in water. The electrolytic tanks take 10 amperes D.C. at 220 volts, and the output is 12 gallons of hypochlorite solution per hour, which is diluted with nine times its volume of water before use in the laundry. Dr. Faulks, assistant medical superintendent, states that the solution is effective in destroying micro-organisms and removing stains, and does not injure textile fabrics appreciably.

Appointments Vacant.—Switchboard attendant (30s.) for Kendal Corporation; sub-station superintendent (£200) for Salford Electricity Department; assistant for testing and calibrating mercury motor meters (during war only) for Edinburgh Corporation; fitter-driver (35s.) for Severalls Asylum, Colchester; senior switchboard attendant (37s. 6d.) for Salford Electricity Department; fitter-driver (£2 2s.) and switchboard attendant (35s.) for Clacton U.D.C.; switchboard attendant (27s. 6d.) for Electricity Works, Lancaster. Particulars are given in our advertisement pages.

Late Legal.—PNEUMATIC BELL DISPUTE.—In the City of London Court on 19th inst., before his Honour Judge Rentoul, K.C., the London Pneumatic Tube Co. made a claim against Veritys, Ltd., for £3 16s. for making a pneumatic Ambulance bell with a 12-in. gong for them. Mr. Clark, who was the plaintiff, said that on September 16th defendants wrote and said they wanted an ambulance bell for their Bristol house. He saw the defendants' manager and told him the bell would have to be specially made. Defendants' manager said they wanted the bell to act similarly to the bells attached to the City of London Police Ambulances, only those were electric, whereas the bell ordered was to be worked by the driver, their cars having no electricity. Defendants asked for an estimate, and he said it would be £3 16s. Then the defendants asked for a blue print, but he said he must design the bell, and he could not give him a blue print without it was regarded as a definite order. Defendants gave him a definite order, and later on wanted to cancel it, which he would not agree to, as he had done half the work. He had had to pay 18s. for a gong, and he designed the striking arrangements.—Mr. Kenelm Preedy, defendants' counsel, said that their Bristol House found that their customer would not go into the matter further. They then told the plaintiffs the order must be regarded as cancelled. The firm order was subject to the approval of the blue print, and it was not approved.—Mr. Clark said there was nothing of that in the correspondence or in the conversations.—Judge Rentoul, K.C., said that the defendants could not play tricks with the plaintiffs as they had done. It was a provisional order, and if the defendants got the order from Bristol then the plaintiffs would get the order. It was necessary to buy a 12-in. gong.—Mr. Clark said he could not have got on without it. He bought it of Barwell's, of Birmingham. He had never seen one before, and he hoped never to see another.—Defendants called a witness, who said that the plaintiffs were told it was a provisional order. It was a new idea, and they only made an inquiry of the plaintiffs. Plaintiffs need not have bought a gong. Defendants referred the matter to their Bristol House. "Blue print to be approved before proceeding," was on the order.—Mr. Clark said that was done after the firm order was given.—Judge Rentoul thought there had been a serious misunderstanding between the parties. He gave judgment for the defendants without costs.

ATTORNEY-GENERAL AT THE RELATION OF THE ILFORD GAS CO. *v.* THE ILFORD URBAN DISTRICT COUNCIL.—This action, by which the plaintiffs sought declarations and injunctions in respect of alleged *ultra vires* acts committed by the defendants in connection with their electric light supply, was settled before Mr. Justice Sargant on Wednesday, January 20th.

Mr. Mark Romer, K.C., who represented the plaintiffs, said that the defendants had agreed to submit to judgment, but they sought to impose certain terms and conditions which the plaintiffs were not prepared to accept. The action might be divided into two parts, one relating to the method by which the Council carried on its electric lighting business, and the other to preferential rates it was alleged they were giving to certain consumers. With regard to the first, the plaintiffs asked for a declaration that the plaintiffs were acting *ultra vires* in carrying on the business of supplying electric lamps, motors and appliances, and in having a showroom for the exhibition of such goods. There was no longer any question that the Council were not entitled to carry on that business, and they did not oppose a declaration to that effect, but the plaintiffs asked for an injunction to restrain them from doing any acts under contracts made in connection with that business. With regard to the second part, which related to the alleged undue preference under the Electric Lighting Acts, there was no question now, having regard to a recent decision of the Court of Appeal, that the new tariff which the defendants proposed to set up was *ultra vires*, because they were favouring the owners of premises which were electrically lighted throughout. The defendants were willing to submit to the declaration the plaintiffs asked for; with respect to that the plaintiffs proposed merely to take the declaration with liberty to apply for an injunction if necessary. With regard to the other part of the case, the defendants said that they having entered into a number of contracts for the supply of flame arc lamps, electric motors and wiring, they were willing to submit to a declaration that such matters were *ultra vires*, but they wanted the plaintiffs to agree not to apply for any injunction in respect of anything done in connection with the agreements that were in force at the present date for a period of 12 months. The plaintiffs, of course, could not consent to anything of the sort. They were willing to assent to three months, but that the defendants said would not do.

His Lordship asked what was the length of these arrangements.

Mr. Romer said he did not know, but there could be no question that they were all *ultra vires*.

Mr. Martelli, K.C., who represented the defendants, said that some were for a year and some were for longer. He was quite willing to submit to a declaration that all these matters were *ultra vires*, and the only question was how long his Lordship would give the defendants to make the best terms they could with those they had contracted with, some of these contracts having many years to run, some five years and some only one year; if the Council were merely to take possession of the motors which were working under the hiring agreements, works would have to be shut down, and a number of people thrown out of employment. There might be considerable difficulty in getting back those arc lamps and motors, with the loss to them of several thousands of pounds, which the councillors might have surcharged against them. It was quite impossible for the users of these arc lamps to make other arrangements, presumably with the Gas Co., for some little time.

Mr. Romer said he could not accept the defendants' statements as to the agreements.

Mr. Martelli said he desired to state quite frankly what the position of the Council was. They took the view that the sale of these arc lamps and motors would not be carrying on a business that was *ultra vires*, and they intended to sell them if they could in order to cut their loss.

His Lordship said that if an injunction was applied for merely because the Council had sold these lamps to a customer who had had them under a hiring agreement, he did not think he should grant it.

Mr. Martelli said that after that expression of opinion, and as no injunction was being asked for, he would leave the matter where it was.

His Lordship: Then I will make the declarations asked for, with liberty to the plaintiffs to apply for an injunction if necessary, and the defendants must pay the costs of the action.

Inquiries.—Makers of black ivoride sheets, "Comstick" dressing for commutators, and automatic staircase switches that switch off after two minutes, are asked for.

University of Hong-Kong.—Not the least remarkable result of the European conflagration has been the demonstration of affection and loyalty which it has called forth from India and this Colony. In the remote island of Hong-Kong the local Chinese have already come forward splendidly, and, together with the British residents, have provided nearly £30,000 for the Prince of Wales's Fund. Nearly all of the British firms, with headquarters in Hong-Kong, have subscribed to the London fund direct, so that the above sum may be considered to come from the residents of the Colony, the very large majority of whom are Chinese. The University of Hong-Kong, which, as our readers know, is entirely equipped with British machinery presented by home firms, has organised a day of demonstration of apparatus, &c., and the students' Union has taken the matter up so energetically that many hundreds of visitors are expected. The charge for admission will go, together with students' subscriptions, direct to the Prince of Wales's Fund. Our readers will also be interested to know that at the outbreak of the war the whole of the members of the Engineering staff volunteered to run night shifts on the local searchlights, so as to enable some of the R.E.'s to go to the front. "Business as usual" has been carried on at the University, despite the night work at the forts.

The Electrical Industry in France.—With the issue for January 2nd our esteemed contemporary, *La Lumière Electrique*, announces that after an enforced cessation of activity due to the loss of the greater part of its staff on account of the mobilisation, it has succeeded in reorganising its arrangements and resuming publication. Tendering our congratulations and good wishes, we add the hope that the valuable services which the journal renders to the electrical industry may never again be interrupted, and that its former prosperity may soon be restored.

The course of events in the financial world since July is reviewed in a special article, and a long list is given of German and Austrian electrical concerns in France over whose affairs control was assumed by the Government.

Copper Famine in Sweden.—According to a wire from Gothenburg it seems that the Swedish State has very great difficulties in getting the necessary supplies of copper for various purposes, on account of the stoppage of the import of the mineral. The telegraph department has been obliged to discontinue the erection of new telegraph and telephone lines because there is a lack of cables and wires. Private industry, and the electrical industry in particular, suffers also from lack of copper, and this applies especially to the large electrical plants at Trollhättan, where the stocks of copper seem to have been nearly exhausted. On the other hand, the United States official returns show that the amount of copper imported from America into Sweden has enormously increased in comparison with previous years. Of course, Sweden would not dream of selling copper to Germany, where the copper famine is said to be even more severe.

Guaranteed Wiring.—At the meeting of the Council of the Electrical Contractors' Association, Incorporated, held at Leeds on Friday last, the 15th inst., it was decided to adopt the guarantee scheme (which has been before the Association for the best part of two years) in its entirety. The scheme, which provides that the Association, as a whole, shall guarantee the wiring work of each of its members individually up to a certain specified amount, will come into force on October 1st of this year. The general indemnity, which is extended to any employer of one of the Association's members, is subject to certain limits and conditions, copies of which will shortly be obtainable from the Secretary upon application. The standard adopted will be practically in accordance with the rules issued by the Institution of Electrical Engineers. It is believed that the effect of this guarantee will be very far-reaching, and that it will remove for ever, as far as the E.O.A. is concerned, the accusation that electric wiring contractors are essentially shoddy workers.

Fatalities.—HEBBURN.—An inquest was held at Hebburn on January 12th on the body of Leslie Oliver Hunt (18), an apprentice electrician, who sustained fatal injuries while following his employment at the works of Messrs. Reyrolle on 6th inst. Deceased, it was stated, received instructions to examine and report respecting an electric lift, and after setting the lift in motion put his head inside the protecting bars, with the result that a counterweight descended upon his head and crushed it. It was further stated that it was unnecessary to act as deceased had done to examine the lift, but the firm undertook, as a further protection, to construct a screen at one end of the lift. A verdict of "Accidental death" was returned.

CAMBUSLANG.—In Gateside Colliery, Peter McCourt, a miner, who was working an electrically-driven coal-cutting machine, was caught in the machinery and sustained fatal injuries.

GLASGOW.—It is reported that whilst fitting up electric wires in a warship at Fairfield Dock, on 12th inst., James Aitken, electrician, aged 44, fell backward, striking an iron guard, and was killed.

KIDSGROVE.—On 14th inst. an inquest was held into the cause of death of William Holley, aged 29 years, who died on 8th inst. as the result of an electric shock received at Birchenwood Colliery. The general manager of the colliery (Mr. Allott) said that the deceased was working as a labourer with the boiler smiths who were repairing the quenching machine on No. 1 coking plant. The machine had five fixed electric lights, 100 volts each, arranged in series, and the current was taken from one phase of the power supply (500 volts A.C.) to the motor operating the machine. Light was taken from the power circuit because the machine was a travelling one. It was understood that the lights were not to be interfered with. According to the *Stafford Sentinel*, Mr. Allott said that in order to provide light for the purpose of completing the repairs, current was brought from the 110 and 120-volt lighting mains 30 yd. away. The electricians fixed two lights by which the boilersmiths could see during the night. In the afternoon a fitter engaged on another part of the machine gave instructions to a youth to fix an extension on to one of the five lights, thinking that because each lamp was at 100 volts the current was at that pressure. Later the deceased handled this particular light, and received a shock from which he died. After other evidence had been heard, the jury returned a verdict of "Accidental death."

Electricity Supply Rifle League.—As a large percentage of the members of the above League are now serving with the Army at home and abroad, the matches between the various clubs composing the League have been postponed. Information is to hand that there are new clubs formed and in process of formation in connection with electricity works, and as some of the League clubs are in a position to arrange friendly matches, such new clubs are requested to get into communication with the League secretary, Mr. E. Mathews, at 306, Mare Street, Hackney, who will be pleased to put them into communication with those clubs who are open for fixtures.

The annual meeting and dinner have been abandoned for this year, but should circumstances permit of a resumption of contests later in the season a meeting will be called to arrange for them.

Some of the League clubs' ranges have been handed over to the military authorities, whilst others are doing good work in connection with local enthusiasts who are patronising the club ranges and taking advantage of the instruction offered by members of the various clubs.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—On January 13th at St. Cuthbert's Church, Sprowston, CAPTAIN G. G. EWER, A.M.I.E.E., 7th Battalion Essex Regiment, was married to Miss Amy Liell Willett, eldest daughter of Captain W. A. Willett, of Leigh-on-Sea. The officers and men of F Company were present at the service, and afterwards formed a guard of honour outside the church. Captain Ewer, who, in normal times, is sales engineer to the Stepney Borough Council electricity department, has been serving with his regiment on the East Coast since the outbreak of war.

The *Commonwealth Engineer* states that MR. E. E. STARK, who for several years past has been city electrical engineer at Dunedin, N.Z., has resigned his position. Mr. Stark originally went to New Zealand from America as engineer for the Waipori Falls power scheme, and, on the retirement of Mr. Goodman as city electrical engineer, Dunedin, to occupy his present position with the Adelaide Municipal Tramway Trust, Mr. Stark succeeded him.

The Bury Electricity Committee has advanced the salary of MR. JOHN MURRAY, chief shift engineer.

The Sunderland T.C. has granted the following increases in salary in the electricity and lighting department:—Chief assistant, from £275 to £300 per annum; works superintendent, £250 to £275 per annum; four shift engineers, £156 to £169 per annum; clerk, £91 to £97 10s., and at the end of 12 months £104.

The Salford Electricity Committee has appointed MR. J. COLLINGE as station superintendent at his present salary.

MR. A. BROWN, chief assistant engineer at the King's Lynn municipal electricity works, has tendered his resignation, he having secured another appointment.

MR. W. A. BROWN, distributing engineer at the St. Pancras electricity works, has resigned his appointment, and will receive a testimonial under the Borough Council's seal in respect of his 17 years' service.

MR. P. J. S. TIDDEMAN, manager of the Llanelly and District E.L. and Traction Co., Ltd., who has received a similar appointment at Carlisle, has been presented by the employés with a bicycle.

MR. JOHN A. PARKER, chief assistant of the Greenock electricity works, has been appointed chief assistant of the Croydon electricity works. There were 187 applicants for the position.

Tramway Officials.—MR. ERNEST JORDAN has been appointed station engineer of the Northampton Corporation Tramways, as from December 1st last. Mr. Jordan was previously assistant engineer and formerly with Messrs. Cammell, Laird and Co., Ltd., of Sheffield.

General.—MR. ALFRED LONGDEN, Assistant Superintending Engineer of the North-Eastern District, has just retired after 45 years' service in the Post Office Engineering Department. A farewell smoker was held at Leeds recently, attended by representatives from the Engineer-in-Chief's office in London, and the principal district officers, and Mr. Longden was then presented with a clock and vases, and Mrs. Longden with a handbag. Mr. T. B. Johnson, Superintending Engineer, made the presentation.

MESSRS. A. A. DIRCKS, electrical engineer for Victoria in the Postmaster-General's Department, G. H. MORGAN, Telephone Manager, Melbourne, and S. L. MONAGHAN, Assistant Telephone Manager, Sydney, who have been investigating telephone traffic requirements in America and the United Kingdom, have returned to Australia.

On Monday next at St. Paul's Church, Whitley Bay, the marriage will take place of MR. GEORGE G. L. PREECE, branch manager in Manchester for Messrs. Bruce Peebles & Co., Ltd., to Miss May Bowie, of Newcastle-on-Tyne, fifth daughter of the late John Bowie. Mr. and Mrs. Preece will reside at Seddon Road, Hale, Cheshire. We are sure that Mr. Preece's many friends in the electrical world, including his former associates at Messrs. Glover's, at Trafford Park, will join with us in congratulating him, and in wishing him and his wife that is to be long-continued happiness.

Obituary.—The death has occurred at Eastney Barracks, Portsmouth, of LANCE-SERGEANT FRANK TOON, of the Royal Marine Artillery. Some years ago deceased was apprenticed as electrician at Shirebrook Colliery. Later he enlisted in the Royal Marine Artillery. After various voyages he was appointed head electrician in the Eastney Barracks. A verdict of "Death from gas poisoning" was returned.

NEW COMPANIES REGISTERED.

W. E. Raybould & Co., Ltd. (138 934).—This company was registered on January 8th, with a capital of £250 in £1 shares, to carry on the business of electric lighting, heating and telephone engineers, suppliers and fixers of electric lighting sets, petrol lighting and private telephone installations, sub-contractors for gas lighting and heating, and hot-water heating, dealers in, contractors for, and constructors of, electrical work, &c., and to adopt an agreement with W. A. Raybould. The subscribers (with five shares each) are:—W. A. Raybould, Theatre Chambers, Babington Lane, Derby, incorporated insurance broker; W. E. Raybould, Jacksons Chambers, St. Peter's street, Derby, electrician. Private company. The number of directors is not to be less than two or more than five: the first are W. A. Raybould (secretary), and W. E. Raybould; qualification, five shares. Registered office, Jacksons Chambers, St. Peter's Street, Derby.

Stanley Goodwin & Co., Ltd. (138,998).—This company was registered on January 14th, with a capital of £500 in £1 shares, to take over the business of mechanical and electrical engineers carried on by S. Goodwin and W. T. Keetley, at Glebe Street, Stoke-upon-Trent, as "Stanley Goodwin and Keetley." The subscribers (with one share each) are:—S. Goodwin, Victoria Square, Henley, electrical engineer; W. T. Keetley, 10, Riseley Road, Harishill, Stoke-upon-Trent, electrical engineer. Private company. The first directors are not named; qualification, 50 shares. Solicitor, F. Collis, Stoke-upon-Trent.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Verltys, Ltd.—Capital, £210,000 in 7,000 5 per cent. first pref. 7,000 6 per cent. second pref. and 6,980 ord. shares of £10 each, and 200 management shares of £1 each. Return dated May 14th, 1914. 7,000 first pref., 7,000 second pref., 6,692 ord. and 200 management shares taken up. £10 per share called up on 4,670 first pref., 7,000 second pref. and 2,492 ord. shares and £1 per share on 30 management shares. 170 management, 2,330 first pref. and 4,200 ord. shares considered as fully paid. Mortgages and charges: £61,400. Two returns of allotments made up to June 11th and July 28th, 1914, show a further 45 ord. and 243 ord. shares allotted for cash respectively.

James Keith & Blackman Co., Ltd.—A memorandum of satisfaction in full (*a*) on May 15th, 1914, of first debs. dated March 10th, 1903, securing £100, and (*b*) on November 26th, of second debs., dated February 9th, 1914, securing £200, has been filed.

Torquay Tramways Co., Ltd.—A memorandum of satisfaction to the extent of £200 on September 29th, and £200 on November 6th, 1914, of charge dated March 8th, 1911, securing £60,000 has been filed.

Maxim Lamp Works, Ltd.—Debenture dated January 1st, 1915, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Imperial United Lamp Co., Ltd., Caxton House, Westminster, S.W.

James Keith & Blackman Co., Ltd.—Issue on January 7th, 1915, of £100 1st and £350 2nd debentures, parts of a series of which particulars have already been filed.

Brilliant Arc Lamp and Engineering Co., Ltd.—Issue on December 22nd, 1914, of £40 debentures, part of a series of which particulars have already been filed.

Prismatic Art Sign, Ltd.—Particulars of £1,000 debs., created January 4th, 1814, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Printex Accumulator Co., Ltd.—Debenture dated January 1st, to secure £500, charged on company's undertaking and property, present and future. Holder: T. B. Batchelor, Hopwood, Alvechurch, Worcester.

Musselburgh and District Electric Light and Traction Co., Ltd.—A memorandum of satisfaction to the extent of £200 on December 18th and £500 on December 31st, 1914, of charges dated November 13th, 1905, and May 11th, 1909, securing £90,000, has been filed.

City of Oxford Electric Tramway, Ltd.—A memorandum of satisfaction to the extent of £1,000 on December 21st, of charge dated February 20th, 1914, securing £46,000, has been filed.

CITY NOTES.

British Columbia Electric Railway Co., Ltd.—A dividend at the rate of 5 per cent. per annum on the 5 per cent. preferred ordinary stock for the half-year ended December 31st is to be paid.

Brazilian Traction, Light and Power Co., Ltd.—The directors have declared a dividend of 1½ per cent. on the ordinary capital.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—The directors report for 1914 a net income, after providing for repairs, maintenance and debenture interest, and including £5,521 brought forward, of £32,045. A dividend of 6 per cent. on the preference shares, as against 4 per cent. for the previous year, is to be paid, placing £8,512 to depreciation renewals reserve fund, and carrying £10,725 forward.

Dublin United Tramways Co. (1896), Ltd.—After setting aside £18 000 towards renewal of rails and placing £5,000 to reserve and renewal fund, a further dividend of 2½ per cent. on the ordinary shares, making 5 per cent. for the year, is recommended; £11,366 is to be carried forward.

Montreal Light, Heat and Power Co., Ltd.—A dividend of 2½ per cent. on the paid-up capital stock, being at the rate of 10 per cent. per annum, is recommended for the quarter ended January 31st.

Anglo-American Telegraph Co., Ltd.—The directors announce a balance dividend of £1 10s. per cent. upon the ordinary consolidated stock for the year December 31st, 1914, less income-tax at 1s. 9¾d. in the £; a balance dividend of £1 10s. per cent. upon the preferred stock for the year, less income-tax at 2s. 1d. in the £; a first and final dividend of £1 10s. per cent. upon the deferred stock for the year, less income-tax at 1s. 6½d. in the £. The above dividends, which are payable on February 1st, together with those already paid, will amount to £3 15s. per cent. on the ordinary consolidated stock, £6 per cent. on the preferred stock, and £1 10s. per cent. on the deferred stock.

Paris Compressed Air Co.—The Compagnie Parisienne de l'Air Comprimé (Popp), whose electric lighting business was transferred to the Compagnie Parisienne de Distribution d'Electricité on January 1st, 1914, now solely carries on the compressed air branch, although it holds 48,651 shares in the latter company and 6,000 shares in the supply company known as the Ouest Lumière. During the year ended on June 30th, 1914, the Popp company's revenue from electricity supply and electrical investments experienced a decrease as compared with the preceding year, whereas the compressed air department had an increase. After placing £63,000 to depreciation, the accounts show net profits amounting to £187,000, as contrasted with £207,000 in 1912-13, and it is proposed to pay a dividend of 9 per cent on the ordinary shares, as in the previous year, whilst the founder shares receive £2 4s. 9d. each.

STOCKS AND SHARES.

Tuesday Evening.

THERE can be little doubt but that the re-opening of the Stock Exchange has increased business. Whether it be that there is a sentimental value attached by the public to the fact of their brokers dealing within walls, under a roof and over a floor, or whether it is by mere coincidence, the public are certainly doing more now than they were at the end of last year. The Treasury conditions, laid upon the Stock Exchange as the price for re-opening, have not been extended to outside sources; and the quaint anomaly remains of an alien enemy being able to realise, with the utmost ease, practically what money he likes on his favourite securities, through the medium of channels outside the Stock Exchange, although the members of the House are fettered by regulations so onerous that they extend to every investor, from the largest to the smallest.

If a man wishes to sell 10 British Westinghouse Preference for example, he has to go through a paraphernalia of ceremonies, in exactly the same way as he who realises £34,000 by the sale of 1,000 Canadian Pacifics. They say that there are a few Stock Exchange men who are not above evading the temporary regulations, but it may be asserted with safety that 95 per cent. of the members are doing their best to comply loyally with rules which they are asked to maintain as a contribution to the national interest.

The electrical markets this week are featured by conspicuous firmness in Eastern and Anglo-American Telegraphs, by a further weakening in Mexican Tramway securities, and by fairly active dealings in Westinghouse Preference, Edison & Swan, and a few other manufacturing shares. Our lists show the principal movements in detail:—

	Mean price. July 27.	Jan. 19, 1915.	Rise or fall this week.
HOME ELECTRICITY COMPANIES.			
Brompton Ordinary	9⅛	8⅞	—
do. 7 per cent. Pref.	8⅝	8⅝	—
Charing Cross Ordinary	5⅛	4⅝	—
do. do. do. 4½ Pref.	4⅜	4¼	—
do. do. City Pref.	4⅛	4	—
do. 4 Deb.	91½	90	—
Chelsea	4⅜	4⅜	—
do. 4½ Deb.	96½	92	—
City of London	16	14⅜	— ⅛
do. do. 6 per cent. Pref.	13½	13	—
do. do. 5 Deb.	116½	114	—
do. do. 4½ Deb.	100½	98	—
County of London	12	11⅜	—
do. do. 6 per cent. Pref.	12	11⅜	— ⅛
do. do. 1st Deb.	102½	99	—
do. do. 2nd Deb.	100½	97	—
Kensington Ordinary	7⅞	7⅜	— ⅛
London Electric	1⅞	1¾	—
do. do. 6 per cent. Pref.	5⅞	5	—
do. do. 4 Deb.	92½	89½	—
Metropolitan	3⅜	3¼	— ⅛
do. 4½ per cent. Pref.	4⅞	4	—
do. 4½ Deb.	97⅞	91½	—
do. 6½ Deb.	89	81½	—
St. James' and Pall Mall	9⅜	9	—
do. do. do. 7 per cent. Pref.	7	6⅜	—
do. do. do. 3½ Deb.	84½	83½	—
South London	3⅛	3	—
South Metropolitan Pref.	1⅝	1⅜	—
Westminster Ordinary	8⅝	8⅜	—
do. 4½ Pref.	6⅜	4⅜	—
TELEGRAPHS AND TELEPHONES.			
Anglo-Am. Tel. Pf.	108½	104	+ 1½
do. Def.	23	22⅜	+ 1
Chile Telephone	7⅜	7⅛	—
Constantinople Tel.	4½	3½	— ½
Cuba Sub. Ord.	8⅝	8½	—
do. Pf.	16½	15⅞	—
Eastern Extension	12⅝	12⅜	+ ⅛
do. 4 Deb.	97½	94	—
Eastern Tel. Ord.	130½	128	+ 6
do. 3½ Pf.	77½	71	— 1½
do. 4 Deb.	96⅜	95	—
Globe Tel. and T. Ord.	11½	10	—
do. Pf.	12⅝	11⅜	— ¼
Gt. Northern Tel.	32½	28	—
Indo-European	59	57	— 1
Marconi	1⅝	1⅜	+ 3/32
New York Tel. 4½	101	97	+ ½
Oriental Telephone Ord.	2⅝	2	—
do. Pf.	1 27/32	1 7/8	
Tel. Egypt Deb.	98	97½	—
United R. Plate Tel.	6⅜	6	—
do. Pf.	5⅞	5	—
West India and Pan.	1½	1½	—
Western Telegraph	13⅝	13	+ ⅛
do. 4 Deb.	96½	95½	—
HOME RAILS.			
Central London, Ord. Assented	83	79	—
Metropolitan	37½	32½	+ 1
do. District	21⅝	18½	+ 1/16
Underground Electric Ordinary	2½	1⅝	—
do. "A"	7/6	6/-	—
do. Income	88	81½	+ 1½
FOREIGN TRAMS, &c.			
Anglo-Arg. Trams, First Pf.	4⅞	4⅜	— ⅛
do. 2nd Pf.	4¼	4 3/16	— 1/16
do. 4 Deb.	91	86	—
do. 4½ Deb.	98½	94	— 2
do. 5 Deb.	96	89	—
Brazil Tractions	66	67½	— ½
Bombay Electric Pf.	11⅜	10½	—
do. 4½ Deb.	96	95	—
Mexico Trams.	70	40	— 5
do. 5 per cent. Bonds	84	70	—
do. 6 per cent. Bonds	76	65	—
Adelaide Sup. 6 per cent. Pf.	5¼	5⅛	—
do. 5 Deb.	104	101	+ ½
MANUFACTURING COMPANIES.			
British Westinghouse Pref.	1⅜	1 3/16	— 1/16
do. 4 Deb.	74½	72	—
do. 6 p. lien	102¼	98¼	—
Callenders	11¼	11½	—
do. 5 Pref.	5⅛	4⅝	—
do. 4½ Deb.	98½	98	—
Castner-Kellner	2⅛	8 7/16	+ 7/16
Edison & Swan, £3 pd.	3/32	12/6	— 6d.
do. do. fully paid	1½	2½	—
do. do. 4 Deb.	59	60	—
do. do. 2 Deb.	63½	60	—
Electric Construction	1/2	11/-	—
do. do. Pf.	1/8	1	—
Gen. Elec. Pf.	10⅜	10	—
Henleys	15	13½	—
do. 4½ Pref.	5	5	+ ⅛
do. 4½ Deb.	100½	97	—
India-Rubber	9	8⅜	—
Telegraph Con.	38½	36	—

Keen attention is centred upon the opening of Parliament, and the possibilities which this will present in regard to the two Bills that have been deposited in connection with London's electricity supply. The County Council Bill stands first in point of magnitude and importance. Part 2 of the Bill is that which arouses most interest in financial circles, since this proposes to empower the electricity authority to create a new trustee stock, redeemable in 60 years by a sinking fund running for the term of 30 years. The Authority, it is suggested, shall have the power to spend ten million pounds on new capital account, and such further sums as may be necessary for the acquisition of the various undertakings. Rumours that the Bill will be withdrawn met with prompt denial, so presumably it will proceed in the ordinary way, although a little scepticism on that point may be permitted.

Reference to the Bill will show that the proposed acquisition is to be carried out by agreement, which, to the ordinary lay mind, naturally suggests that the companies would demand payment on the basis of profits spread over a number of years, plus goodwill and allowance for undeveloped areas of supply. Putting the number of years, for the sake of argument, at 25—which seems to be a probable period—and making allowance for the other two items and sinking fund requirements, the observer would work out these totals to something like 22 to 25 million pounds sterling. Add the usual trimmings, and it might not be far out to prophesy that something near 40 million pounds sterling would be wanted to work this scheme. A separate Authority is, of course, an integral part of the scheme; and the Bill proposes that if this Electric Authority is satisfied that its receipts on revenue account in any year are likely to be insufficient to meet the charges payable out of revenue, the Authority shall levy a deficiency rate apportioned amongst the Councils in proportion to the assessable value of the areas within the area of supply.

Having regard to the huge field which the scheme covers—East and West, North and South of London—this last suggestion opens up a prospect hardly pleasing to the champions of cheap electricity supply for London, or to those undertakings in a densely-populated area which might be called upon to make up a probable deficiency, at least for some time, incurred by the authority in comparatively sparsely-peopled places in Surrey, Middlesex, Bucks., and Hertford. It might be supposed that the companies would cordially support a scheme whereby they should be paid out on goodwill terms in a trustee stock that would have a first charge upon the revenue of the new authority; but from the point of view of the outsider, interested more as a consumer and ratepayer than as a holder of electricity supply shares, the outlook is less alluring.

The companies—or at least some of them—do not wish to be disturbed, however; and several are promoting a Bill of their own, conceived, as we said before, on more modest lines, but lacking the adhesion of various important members of the London electrical undertakers, without whom it would be practically impossible to attain the great desiderata of central supply and cheap current which Parliament will certainly demand as a condition of authorising any such amalgamation plan.

We must repeat once more that, with the Government a large borrower on war account, any proposals that call for the raising of substantial sums of money are bound to be regarded coldly just now, more especially if they involved such competition as the creation of another trustee security would necessitate. The Treasury has intimated this week that issues for undertakings carried on, or to be carried on in the United Kingdom, shall only be allowed where it is shown to the satisfaction of the Treasury that they are advisable in the national interest, so that the prospects for either Bill look none too rosy at the moment.

It is no part of ours, of course, to fling hyper-austere criticism at schemes that aim at the achievement of such an object as unification of London's electric supply. But, in this part of the ELECTRICAL REVIEW at all events, it is finance that counts mostly; and therefore one is bound to examine with a good deal of closeness each proposition as it is brought forward. The critic welcomes each honest scheme, though it may seem unsound in parts, since all these proposals are working towards the goal which must one day be reached. The sooner the end is attained, the better will it be for everybody; but to build upon insecure foundations would simply mean the work having to be done over again, unless London is to be saddled with a burden more heavy and costly than prevails at present, and the great conclusion of cheap lighting and power be defeated through indiscreet action at the outset.

The prices of Home Railway stocks again show advances in most cases on the week. This time the improvement has spread to the electrical issues. Underground income bonds are 1½ up at 81½, and the 4½ per cents. are better at 98½. The company's 6 per cent. 1st cumulative income Debenture stock stands at 112, which is within a couple of points of the mean price at the end of July. Metropolitans have hardened, and Districts rose ¼. There is more business passing in the pre-Ordinary securities. Metropolitan 3½ per cent. Preference changed hands at 76½, District Firsts at 76.

Eastern Telegraph Ordinary stock has risen 6 points, fairly rapid justification for our contention last month that the stock was undervalued at 118, seeing that now it stands at 128. Eastern Extensions move more slowly, and have fallen behind the Eastern stock. The Telegraph market as a whole is very firm. Westerns are better, and both classes of Anglo-American Telegraphs responded to the declaration of the usual dividends, making 6 per cent. on the Preferred, 3 per cent. on the Ordinary, and 1½ per cent. on the Deferred, for the past year. New York Telephone bonds are good; and of the outside shares, Marconis once more gained a small fraction. American Marconis dropped a trifle to 9s. 9d.

The Treasury's restrictions with regard to new issues, already quoted earlier in this article, are welcomed by investment markets in the Stock Exchange, on the assumption that removal of the possibility of such competition as new issues afford will have a strengthening effect upon existing securities. Incidentally, it may be remarked that the Treasury's solicitude to husband home resources is interpreted in some quarters as a quiet hint that there may be another War Loan before long. The recent issue was supposed to provide the sinews of war up to the end of July, but the City looks for further borrowing about May.

Manufacturing shares are generally strong. British Westinghouse Preference have been done at 40s. Henleys are 10s. up at 13½. Another section of noticeable strength is that for Armament shares. Armstrongs have risen from 39s. to 42s. Vickers are better, and lively dealings have sprung up in the shares of the Projectile Company. Castner-Kellners have risen to a little over 3. The Rubber market keeps fairly firm, with a good deal of trade being done in the popular shares.

MARKET QUOTATIONS.

OWING to the war, the prices given below are, of course, more or less nominal.

Wednesday, January 20th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric .. .. per cwt.	4/6	..
a " Nitric .. .. .. "	19/-	..
a " Oxalic .. .. .. per lb.	8d.	..
a " Sulphuric .. .. .. per cwt.	5/-	..
a Ammoniac Sal .. .. .. "	£49	..
a Ammonia, Muriate (large crystal) per ton	£49	..
a Bleaching powder .. .. .. "	£8 10	..
a Bisulphide of Carbon .. .. "	..	..
a Borax .. .. "	£18 10	..
a Copper Sulphate .. .. .. "	£24 10	..
a Lead, Nitrate .. .. .. "	£35	..
a " White Sugar .. .. "	..	..
a " Peroxide .. .. .. "	..	..
c Methylated Spirit .. .. .. per gal.	..	..
a Potassium, Bichromate, in casks per lb.	7d.	..
a Potash, Caustic (88/90 %) .. per ton	..	..
a " Chlorate .. .. .. per lb.	1/4	2d. inc.
a " Perchlorate .. .. "	1/-	4d. inc.
a Potassium, Cyanide (98/100 %) .. " (for mining purposes only)	Nom.	..
a Shellac .. .. per cwt.	65/-	..
a Sulphate of Magnesia .. .. per ton	£5 10	..
a Sulphur, Sublimed Flowers .. "	£11 10	..
a " Recovered .. .. "	£8	..
a " Lump .. .. .. "	£8 10	..
a Soda, Caustic (white 70/72 %) .. "	£'0 2 6	..
a " Chlorate .. .. .. per lb.	8½d.	½d. inc.
a " Crystals .. .. .. per ton	45/-	..
a Sodium Bichromate, casks .. per lb.	3¾d.	½d. inc.
METALS, &c.		
b Aluminium Ingots, in ton lots .. per ton	£85	..
b " Wire, in ton lots (1 to 14 S.W.G.) "	£112	..
b " Sheet, in ton lots .. "	£112	..
b Babbitt's metal ingots .. .. "	£50 to £221	..
c Brass (rolled metal 2" to 12" basis) per lb.	8½d.	½d. inc.
c " Tube (brazed) .. .. "	10d.	½d. inc.
c " " (solid drawn) .. "	9d.	½d. inc.
c " Wire, basis .. .. .. "	9d.	½d. inc.
c Copper Tubes (brazed) .. .. "	10½d.	½d. inc.
c " " (solid drawn) .. "	10½d.	½d. inc
g " Bars (best selected) .. per ton	£80	£2 inc.
g " Sheet .. .. .. "	£80	£2 inc.
g " Rod .. .. "	£80	£2 inc.
d " (Electrolytic) Bars .. "	£61 10	..
d " " Sheets .. "	£79 10	..
d " " Rods .. .. "	£67 10	..
d " " H.C. Wire per lb.	8½d.	..
f Ebonite Rod .. .. .. "	3/-	..
f " Sheet .. .. .. "	2/6	..
n German Silver Wire .. .. "	1 8	..
h Gutta-percha, fine .. .. "	6/10	..
h India-rubber, Para fine .. .. "	2/7	2½d. dec.
j Iron Pig (Cleveland warrants) .. per ton	53/6	..
l " Wire, galv. No. 8, P.O. qual. "	£16	..
g Lead, English Pig .. .. .. "	£19 to £19 5	..
m Manganin Wire No. 28 .. .. per lb.	..	..
g Mercury .. .. per bot.	£11 10 0	5/- inc.
e Mica (in original cases) small .. per lb.	4d. to 2/6	..
e " " " medium "	3/- to 5/-	..
e " " " large .. "	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c. .. .. "	Nom.	..
p Phosphor Bronze, plain castings "	1/1 to 1/3½	..
p " " rolled bars & rods "	1/0½ to 1/3	..
p " " rolled strip & sheet "	1/2½ to 1/6½	..
o Platinum .. .. per oz.	185/-	..
d Silicium Bronze Wire .. .. per lb.	10½d.	..
r Steel, Magnet, in bars .. .. per ton	£70	£5 inc.
g Tin, Block (English) .. .. "	£161 to £163	..
n " Wire, Nos. 1 to 16 .. .. per lb.	2/3	1d. inc.
p White Anti-friction Metals .. per ton	£44 to £194	..
k Zinc, Sh's (Vieille Montagne bnd.) "	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

THE NATIONAL ELECTRICAL CODE AND BRITISH WIRING RULES COMPARED.

BY FRANK BROADBENT.

In a recent number of the *New York Electrical Review and Western Electrician* a comparison is made between the wiring rules in vogue in the United States, in Germany and in England. The American rules are those known as the National Electrical Code, which is revised every two years, and it is no doubt because the time for the next revision is approaching that this detailed comparison has been made. The rules set out in three parallel columns occupy about eight complete pages of the paper, although the comparison covers only the rules for erection in interiors and does not touch other branches of wiring work or the details of materials.

Generally speaking the National Code appears to be much too detailed, and it is possibly this fact which made such frequent revision necessary. When rules such as those of the Home Office and Institution of Electrical Engineers are drawn up to cover general principles rather than details of manufacture such frequent revision is not necessary, because so long as any new piece of apparatus complies with the general regulations laid down there is no need to modify the rules in order to bring it within their scope.

Take, for instance, the question of fuses or cut-outs: the Home Office Regulation No. 5, consisting of about 80 words, covers not only fuses, but circuit breakers also, and deals with the subject fully from the point of view of danger to work-people.

In the Institution Rules the whole of the references to fuses, as regards their mode of installation or position in the circuit in which they are to be placed, are contained in about 200 words scattered over many pages, because they appear under several headings, involving a certain amount of repetition. The conditions to be fulfilled by fuses from the point of view of fire hazard are covered by about 320 words, the references covering such things as the prevention of risk to the installation or the apparatus protected, and of the overheating of the fuse itself.

Now when we turn to the National Code we find that something like 400 words are devoted to the method of installing, or the positions in which fuses are to be placed, and in addition there are over 2,000 words of descriptive matter referring to details of construction.

Notwithstanding the considerable amount of space devoted to details, the Code specifically states that these "are but a partial outline of requirements. Devices or materials which fulfil the conditions of these requirements and no more, will not necessarily be acceptable. All fittings and materials should be submitted for examination and test before being introduced for use." From this it might appear that any new or improved device might be condemned by an inspector of the National Board of Fire Underwriters on the ground that it had not been officially passed, even although it might comply with the regulations and be more suitable to its purpose than previously existing types which had satisfactorily passed the test.

"Link" fuses, that is to say bare wire fuses, are approved under certain conditions by the National Code. They must not be mounted on porcelain bases but on slate or marble, and must be enclosed in a cabinet box (equivalent to our distribution fuse box) which itself must be made in accordance with regulations which specify the minimum thickness of the metal to be used, the space between the door and the fuses, and between any part of the metal case and live metal, the thickness of the insulating linings, the thickness of the glass panels, the mode of constructing the doors and so on; and the cabinet must be plainly marked with the manufacturer's name. There are many distribution boxes of approved make in this country which would not comply with the requirements here laid down, and practically all our link fuses are carried on porcelain bases or supports.

Another rule with which British practice does not comply is that wooden or composition cabinets "must not be used on metal conduit, armoured cable, or metal moulding systems." Hard wood distribution boxes, suitably lined with fireproof material and provided with metal plates or other means of bonding the conduits together, are very commonly used for interior wiring when the conductors are run in conduit. In some respects they are safer than metal boxes.

The requirements of the National Code as to the placing of fuses in the neutral wire of a three-wire system do not conform to English practice. According to our Institution Rules "no fuse may be placed in the neutral conductor of a multiple wire system, but fuses must be placed on both conductors of two-wire circuits branching therefrom." According to the National Code fuses, under some conditions, must be placed in the middle or neutral wire, but *may be* omitted "provided the neutral wire is of equal carrying capacity to the larger of the outside wires, is earthed"; and when the fuse *is* omitted, branch circuits must be run as two-wire circuits and protected by fuses on both poles. From this it would appear that when a fuse is placed in the neutral conductor no fuse need be connected in the wires branching from the middle conductor. The reason for this regulation is not at all clear, because if a fuse in the middle wire of an unbalanced system failed, the lamps or motors on one side would receive an abnormal pressure without necessarily blowing the fuse of the branch conductors.

Another point in which the National Code differs from British practice is in regard to fused rosettes or ceiling roses. It appears that "on open work in large mills approved link fused rosettes may be used at a voltage of not over 125, and approved enclosed fused rosettes at a voltage of not over 250, the fuse in the rosette not to exceed 3 amperes." Not only is this against British practice, but it was due largely to the danger arising from fused ceiling roses in textile factories that the practice was originally disapproved, whereas it is precisely in this class of work that it is approved in America. Further, the dangers arising from the scattering of molten metal are greater on the lower than on the higher pressure, owing to the greater mass of metal employed in the fuse, yet bare fuse wires are permitted on the lower voltages.

The plain link fuse with fixed screw terminals is practically obsolete in this country for interior wiring, some form of bridge or fuse carrier being invariably used, and whilst our own rules specifically mention that enclosed fuses are preferred there are many types of bridge in which the fuse metal is exposed. These however are gradually going out of use owing to the fact that they are not in line with the Home Office regulations. The Home Office regulations do not of course apply to ordinary domestic installations, but manufacturers who make fuses to comply therewith, and contractors who carry out both factory and domestic wiring, naturally aim at some kind of uniformity, so that as the Home Office insist upon enclosed fuses, and the Institution Rules express a preference for them, the tendency is all in the direction of the enclosed or protected type.

Another point which will strike British contractors as a somewhat curious one is the fact that on motor circuits where overload circuit breakers are used, fuses must be employed in addition, although single-phase motors may have a circuit breaker on one pole and an approved fuse on the other. This rule

applies to all circuits where the current is not too great for an approved enclosed fuse. Without further explanation one can only assume that American circuit breakers of comparatively small carrying capacity have not proved themselves to be satisfactory. We have heard of large circuit breakers on railway switchboards welding up solid due to a sudden and abnormal overload and so preventing their breaking circuit, but have never heard of this in connection with comparatively small circuit breakers.

Manufacturers who have hopes of developing export trade to America and Canada will be more interested in the details of manufacture than in the methods of installing the apparatus. As mentioned above, the rules dealing with construction are far more lengthy and more detailed than those dealing with the mode of installing, and in the 2,000 odd words we have rules dealing with the depth of countersinking for screw heads, the melting point of the waterproof composition which covers such screw heads, the number of screws to be used to support fuse bases, the diameter of ferrules, the thickness, width and length of contact blades, and diameter and length of the cartridge tubes; and, in addition to the descriptive matter, there are two pages of dimensions of cartridge fuses, which appear to be the most approved type. In fact an explanatory note lays it down that "the enclosed or cartridge type of fuse cannot be improperly used for higher currents than those for which they are designed." This is distinctly against all experience with cartridge fuses, as not only is it possible to fit a larger fuse-wire in a cartridge than that originally fitted, but it is difficult, and in some cases impossible, to tell by inspection what size of fuse-wire has actually been fitted. In this connection the open type fuse has the advantage, and possibly this is its only advantage. Not only can a cartridge fuse be abused in this way by installation attendants, but it is not uncommon for manufacturers themselves who have run short of stock of a particular size of fuse wire to substitute a larger fuse than that for which the cartridge is stamped, and simply alter the marking. So far as our experience goes there is no fuse on the market, not even the most modern screw plug fuses, which cannot be tampered with, as even these can be short-circuited or by-passed across the terminals with a fuse wire of practically any size. This in fact is what is generally done when such a fuse blows and there is a shortage of refills.

Turning now to the requirements in relation to switches, the Home Office Regulations Nos. 3 and 4 deal in less than 150 words with the question of safety to persons employed on the premises where switches are employed, and also to those actually using the switches. They define generally the position in which switches are to be placed and the principles of construction. The Institution Rules in about 250 words cover the method of installation of switches, and their position and function, and give sufficient general guidance on details of construction to cover the questions of overheating, arcing and protection to users.

The National Code on the other hand, after occupying about three times the space with rules as to the installation and use of switches, contains seven pages, or about 2,000 words dealing with specific details of manufacture. This does not include motor starting switches, to which another six pages are devoted. One cannot, of course, judge as to the comparative merits of a set of rules drawn up to meet similar needs by a comparison of their prolixity, but it will be agreed that conciseness when coupled with clarity of expression is very desirable in a code of rules intended primarily for the guidance of the contractor and wireman, and moreover, the nature of the details specified produces the impression that they have been drawn up rather to suit some particular make of approved switch than to ensure compliance with general conditions based on a definite and scientific plan.

In some respects the National Code is more definite than our Institution Rules, *e.g.*, the rule relating to the installation and function of the main switch. Our rules require that the main switch on an installation fed from a public supply shall be easily accessible and placed as near the entry of supply as possible. They do *not* state that it shall cut off pressure from all apparatus, and it is common practice for supply authorities to fix their main fuses and meters on the live or supply side of the switch, so that they are always alive whether the main switch is on or off. In the National Code the rule is quite definite on this point, viz., "service cut-out and switch must be arranged to cut off current from all devices including meters." Instances have come under notice in this country of clock meters having been inadvertently connected on the consumer's side of the main switch, with the result that after being switched off they do not restart, and unregistered units have been consumed. This may be the principal reason for connecting meters generally on the supply side of the switch.

Among the considerable details of switch construction given in "Class D" of the code, it is specified that nothing but slate, marble or porcelain may be used for knife switch bases unless any other material proposed is first submitted for special examination. The number of supporting screws must not be less than four if the area of the base is over 25 sq. in. Such screws between parts of opposite polarity must be countersunk and there must be at least $\frac{1}{2}$ in. surface distance between the head of any supporting screw or washer and any live metal. Contact jaw mountings must be secured by at least two screws or some equivalent to prevent turning, and nuts or screw heads on the underside must be countersunk not less than $\frac{1}{8}$ in. and covered with waterproof compound which will not melt below 150 degrees F. This refers to the base only. Then there are regulations and restrictions as to the hinges of the contact blades, the blades themselves, the cross bars and connections. Thus the contact area of the blades must be the equivalent of 1 sq. in. of pure copper per 75 amperes, and the section of metal must be proportioned for a rise not exceeding 50 degrees F. The electrical test specified is quite moderate, viz., a "50 per cent. overload in amperes and 25 per cent. excess voltage" under the most severe practical conditions. It may be assumed from this that the excess current and voltage are to be simultaneously applied and that the circuit may be inductive.

The foregoing requirements appear to apply to "knife" switches of any size and type, and for any voltage up to 550; so the ordinary tumbler switch or any other pattern which has not a quick make and break would come under this designation. Very few, if any, tumbler switches, which are as rare in the States as "snap" switches are in this country, would meet the requirements.

Another point of interest to manufacturers is that all switches must be plainly and visibly marked with the name of the maker, and the rated current and voltage; and service switches must indicate whether the current be "on" or "off." It would be interesting to know if in the case of a "push-and-pull" switch the position of the knob or handle is accepted as a sufficient indication.

(*To be continued.*)

Portable X-Ray Apparatus.—The French Red Cross, 25, Knightsbridge, W., is badly in want of ten specially constructed cars equipped with X-ray apparatus, dark room, &c., for use immediately behind the firing line. Such cars cost, completely fitted out, about £800 each.

THE CASE FOR THE ELECTRIFICATION OF FLOUR MILLS.

By Ernest P. Hollis, A.M.I.E.E., A.Am.I.E.E.

Flour mill electrification is a problem which has not yet ceased to exercise the mind of the engineer charged with the erection and operation of flour mills. Quite recently the question was debated before the Institution of Mechanical Engineers, and a perusal of the observations then made demonstrates that on many fundamental points the flour mill engineer fails to appreciate the benefits that accrue from the electric drive. As in many industries, the question of electrification as appreciated by the miller turns practically wholly on the cost per b.h.p.-hour at the engine, and if the steam or gas engine maker can convince the miller that the cost per b.h.p.-hour at the engine is less than if the engine were replaced by one motor—for, be it noted that the miller is persuaded that there is little scope for the individual drive—then he considers the case against electrification to be made out.

It is one purpose of this article to traverse many of the statements made against the electrification of flour mills in the hope that they will provide material for an attack upon the rooted convictions against electrification which are largely held by millers.

The Consumers' Engineer in his campaigns is often placed in the difficult position of being unacquainted with many of the processes to which he hopes to introduce electrification. The engineer who goes to talk electrification to a cement works engineer is soon placed in difficulties when the cement works engineer asks "How would you drive the cylpebs? Would you drive them from the same motor as the kominor?" Or if he interviews a flour mill engineer who enquires after the driving of plansifters or cockle extractors, it is not a hopeful augury of success to acknowledge ignorance. It is hoped therefore to afford Consumers' Engineers unacquainted with flour milling the necessary outline of milling to enable them to talk confidently to the miller; and also to acquaint him with the points he is to drive home, the arguments he is likely to meet and how he may controvert them. On the ability to undertake this the success of his mission depends.

First let a brief conspectus of the treatment of the grain be given. Flour milling divides itself into four different processes:—(*a*) grain handling; (*b*) wheat preparing; (*c*) flour milling; (*d*) packing and storing the finished products. The processes are automatic and eliminate labour to a very large extent, and this fact, coupled with the heavy capital cost of the machinery, is responsible for the long running hours of the mill. Often a mill operates continuously 144 hours a week, and in busy times the whole week through.

Although the plant is sub-divided in the manner which has been mentioned, the grain passes automatically from one portion to the other without human intervention, and this fact plays a prominent part, as will be discussed later, in the electrification question.

The four main processes enumerated can be again sub-divided as follows:—

(*a*) *Grain handling plant*:—

1. Wheat intake from the boats or trucks.
2. Weighing and preliminary cleaning plant.
3. Storage silos.
4. Mixing and conveying plant, passing on to process (*b*).

(*b*) *Wheat cleaning plant*:—

1. Dry cleaning plant.
2. Washing, drying and conditioning plant.
3. Storage bins for conditioning the wheat passing on to process (*c*).

(*c*) *Flour manufacturing or rolling mill plant*:—

1. Granulating or breaking down process
2. Scalping and grading.
3. Purification.
4. Reducing purified stock to flour.
5. Flour dressing, the flour passing on to process (*d*).

(*d*) *Sacking off, warehousing and storing the finished products.*

Grain handling plant.—The grain is elevated by bucket elevators from the quay side and delivered to a travelling band fed at different points by various sets of legs. It passes first to the preliminary cleaning plant, consisting of an automatic weigher registering the number of tips, next through the separator composed of oscillating riddles. While the grain is being riddled powerful air currents remove light chaff and dust. It is then elevated to the silo house or wheat store by travelling bands. These silos are usually large concrete receptacles holding many thousands of tons of wheat. When drawn from the silo for treatment the wheat is fed by bands and elevators into a set of storage bins usually located in the wheat cleaning section. Up to this point different kinds of wheat have been separately stored, but they are blended here in definite proportions. The product then passes on to the wheat preparing plant.

Wheat preparing plant.—Here the berries are treated to remove both smaller and larger impurities; they are rubbed for loosening dirt, scrubbed with stiff brushes, subjected at a number of points to the action of wind currents to carry off the loosened light floating dust.

The next stage is the removal of the small cockle seeds from the wheat by "cockle cylinders." These are composed of rotating cylinders with pitted internal peripheries. The machine relies for its operation upon the difference in shape of the cockle and the wheat, the former being round and the latter oval. When the cylinder rotates the oval grains drop out of the pits first while the spherical ones stay longer, eventually falling on a hopper which separates them from the wheat. They are collected at the bottom of the hopper and removed by a worm conveyor. They are not wasted but are used for cattle food.

An alternative to the cockle cylinder is an extracting band similar in principle and composed of travelling plates given a rapid cross shake. These plates are pitted with holes which hold the cockle seeds which are collected in a similar manner to that previously described.

Wheat Washing.—The wheat is next washed for cleansing and for softening the harder varieties. It is fed on to a washing worm and floats on the surface of the water, the stones remaining in the worm, which is submerged. The flow of water carries the wheat along, and it is drained in a centrifugal machine.

Conditioning Plant.—In the conditioning plant the wheat undergoes a warming process which sweats out the superfluous moisture from the inside of the berry. This moisture is removed by warm and cold currents of air. The wheat is then passed to the conditioning bins where it is stored for a period, after which it is ready for the rolling process.

Rolling Plant.—In the rolling process the berry is broken down and the kernel extracted. The breaking down is done in roller mills, there being about four stages in which it passes through fluted rolls of various coarsenesses. It is worthy of note that no attempt is made here to produce flour which is the outcome of a final rolling later in the process.

The next process is the scalping when the husk is separated from the kernel. As the wheat emerges from the rolling mills into a hopper it is subjected to a light suction from a fan, with the result that the lighter particles are drawn to one side, while the heavier, composed of high class semolina, being less affected by the air suction fall into a different hopper. The heavier particles then pass on to the semolina duster in which they fall through an inclined sieve and the lighter ones are again separated. Again the product drops into a purifier where it is subjected to further air currents and the lighter particles again drawn off. From the purifier the stock passes to the reduction rolls in which it is finally ground. It is then termed "flour." Lastly it goes to the flour dressing machine. Here the flour is reduced to an extremely small size either in a "plansifter" composed of sieves in motion and scraped by brushes, or in a centrifugal machine.

After leaving the dressing process the flour is fed into sacks by means of conveyors, and the dust and other products are disposed of in a similar way. The packing room is usually in the upper floor of the warehouse and the sacks are dropped through sack chutes, or in some other way brought to the ground level.

Grinding.—Another department is the grinding house in which a number of grinding stones are used for the production of wholemeal and the reduction of certain of the by-products to make animal food.

The case for electrification.—The case for the electrification of flour mills is rarely understood by millers. They are obsessed by two assertions which have been urged upon them as militating against the necessity for electrification. These assertions are:—

1. The plant runs as a complete unit from the time it is started until the time it is shut down. Individual drive on which the case for electrification in many industries turns is here, they have been told, useless.

2. The plant is usually driven from a central point, and it is therefore unnecessary to incur the losses due to the change of energy from steam to electrical and its re-conversion to mechanical power.

These specious arguments appeal strongly to the the uninitiated, and it requires a close knowledge of flour milling to be able to convince the miller. Perhaps in the first place it is of interest to know that electricity is called in to assist the miller in practically every installation, for two purposes:—

1. For the lighting of the mill. The explosive nature of the flour dust which permeates the atmosphere absolutely precludes in some of the departments an open light such as gas.

2. In practically every case the outlying drives such as elevators for the wheat intake plant must be driven electrically, and only in a few instances can the rope drive be applied.

When therefore the miller talks of electrification he usually is referring to what may be called the mill proper, and he requires no convincing of the advantages of electricity for lighting and for the outlying drives.

Coming first to the question of individual drive, when it is said that there is no scope for an individual drive the best answer is to show the doubter an electrically driven mill. There he will find much to his surprise that there *is* scope for the individual drive, and that motors are dotted all over the place as one would find them in an ordinary engineering works. Perhaps he cannot understand it, but it must be pointed out to him that the reason why he did not see the necessity for individual drive was because in the steam driven mills, to which he has been used, the designer has been compelled to arrange the machinery in order to meet the exigencies of the drive. The designer has not been free to put his plant where he liked, and has therefore been forced to go in for inconvenient arrangements which conflict with his discretion. In the electrically driven mill the designer puts the plant just where he pleases and is not dictated to by the position of the line shafting. Secondly, there comes the question of efficiency. The miller cannot see that the electric drive is efficient because of the double conversion. The answer is that the losses in converting and reconverting the electrical energy are in most mills less than those incurred in a steam driven mill. Where the line shafting is kept in first-class order and is thoroughly well tended, and where the arrangement of the mill prevents any irregularities in the arrangement of the shafting, it is possible that the electric drive might be at some small disadvantage. But few line shaftings attain the degree of perfection which is disclosed by those on which published tests are taken, and when one comes to examine the matter it is usually found that while the difference in many cases may be only slight it is rarely against electricity.

There is one advantage of electrification which is understood by millers and that is the constancy of speed. A number of operations in the mill depend upon delicately adjusted air currents. If the air currents vary in strength, the desired separations are not effected, and a deterioration in the quality of the product follows. This advantage is generally acknowledged.

Further, there are some important general advantages of electrification which do not occur to the miller and which it is well to impress upon him. First, there is the increased output of the mill. Due to the constancy of speed, the output of an electrically-driven mill is greater than that of the steam-driven mill. This fact is vouched for by so eminent and unbiased an authority as Mr. C. J. Robinson (Proceedings of the Mechanical Engineers, 1913, page 1036) who says:—

"It had been proved, for instance, that an electrically-driven mill could be relied on to increase the output not less than 7½ per cent. over the same mill driven by steam power."

This increase of production is an experience common to many industries where the electric drive is introduced, as, for instance, textile mills and rolling mills. In addition, the speed uniformity ensures evenness in the grinding and dressing processes, which tends to a higher class of product. This is the experience of electrically-driven flour mills.

With the electric drive an important advantage is gained by virtue of the ease with which electrical power can be measured. When a prominent manufacturer of flour machinery recently undertook to analyse the power required to drive a flour mill—the results of his investigation form the basis of a paper read at a recent convention of the National Association of British and Irish Millers—how did he make his measurements? There was no other convenient way than by means of an electric motor. Now, it is well-known that in flour mills a great loss of power can be unknowingly incurred. It has, for instance, been found that fluted rolls, as used in the breaking-down mills, when they become dull incur a considerable loss of power. How is the flour miller to detect it in a steam-driven mill? He can only do it by keeping an eye on the ammeter of an electric motor. The same applies to the mill stones, and it will be found, generally speaking, that the miller can effect considerable economies in the power taken without deteriorating the quality of the product or diminishing the output of the mill.

The elimination of long lengths of shafting naturally diminishes the amount of noise made in the mill. This, however, in milling work is no very great advantage, owing to the small number of the employés. The reduction in the length of belting, however, is a material advantage for obvious reasons.

In conclusion, the Consumers'-Engineer has a number of examples of electrification of flour mills

to which he can point as exemplifying the advantages of the electric drive, and it can be safely said that, if any doubting miller is referred to any of these mills for information, he will receive a satisfactory testimonial which should remove any doubts he entertains on the question.

When Consumers' Engineers have the opportunity of quoting an outside power supply for flour mills it is desirable that they should remember the extraordinary good load factor, and they would do well also to bear in mind that responsible authorities have told the flour millers that in order to make electrification pay it must be supplied at a cost of 0.4d. per KW.-hour or under. This dogmatic assertion is not accepted by electrical engineers, but the figure is well worth keeping in mind in order that they may not kill business by quoting an impossible price.

CAB SIGNALS ON BRITISH RAILWAYS.

(Abstracts of Papers read before the INSTITUTION OF MECHANICAL ENGINEERS, *December 18th, 1914.)*

Electrical Cab-Signalling.

By VINCENT L. RAVEN, CHIEF MECHANICAL ENGINEER, NORTH EASTERN RAILWAY.

This system, designed by the author, has been in actual use on the Richmond branch of the North Eastern Railway for over two years, and also on that part of the North Eastern Railway's Co.'s main line which is situated between Durham and Bensham, and during the whole of that time the arrangement has given every satisfaction; and on no occasion has the danger signal ever been omitted to be given. The apparatus is fitted to thirty-six locomotives.

The main objects of the system are:—

1. To advise the driver of his approach to a signalling zone where signals are to be looked for.

2. To give the driver the necessary information with regard to the position of the signals controlling his further advance, and to prevent him from mistaking other signals than his own.

3. To retain control of the driver by the cab-signals until he has passed the last signal-controlling entrance into the section ahead.

The system comprises VISUAL and AUDIBLE indicators, and the apparatus is electrically operated. The VISUAL INDICATORS on the engine consist of a small semaphore, and one or two pointers capable of being deflected to indicate numbers painted on the dial. The semaphore arm, *together* with the operation of the small pointer, indicates "condition" signals, and the small pointer, by the number indicated, also gives the "route" indication. The AUDIBLE INDICATOR is an electric bell, which is separate from the visual apparatus.

The engine circuits are brought into operation by the movement given to a metallic shoe linked to a small switch when passing over insulated metallic bars placed in suitable positions on the track, and currents are collected from the bars by insulated steel wire brushes brushing lightly but firmly over the bars as the engine passes over them.

The semaphore and bell are directly operated by a battery carried on the engine. The "route indicators" are directly operated by currents established by the signalman in the operation of the ordinary levers of the STOP line signals. These currents also indirectly operate the semaphore and bell.

Fig. 1 is a diagram showing the complete cabin equipment for a two-way diverging junction, together with the circuits on an engine approaching the junction. *Sh* is the shoe, and *Sw* the switch controlling the engine circuits, and *br* are two insulated steel wire brushes, which pick up current from the cabin batteries under certain conditions, by contact with the bars B, C, D, E, and E¹, all of which are connected with the cabin equipment by line wires. The bar A is not connected with the cabin equipment.

Assuming that a train is travelling in the direction shown by the arrow, when the shoe, *Sh*, passes on to the bar A, the semaphore arm will immediately rise to the DANGER position, and the "route indicator" pointer takes up the central position between the Nos. 1 and 2. The bell will begin to ring as soon as the shoe, *Sh*, has passed over the bar. These indications continue until the engine arrives at the bar B.

If the line signals are at DANGER, as shown in fig. 1, the switch, *Sw*, is broken by the lifting of the shoe, *Sh*, as soon as the latter runs on the bar. The bell stops ringing whilst the switch, *Sw*, is broken, but the semaphore arm remains at DANGER. The brushes, *br*, *br*, run over bar B at the same time as the shoe, *Sh*, but as bar B is not energised when the line signals are at DANGER they have no effect. As soon as the shoe, *Sh*, is clear of the bar, the switch, *Sw*, is made again, and the bell recommences to ring. When passing over bar C, the same action takes place. If the engine is stopped at the HOME signal, the shoe and brushes are resting on bar D. In this position the semaphore arm remains at DANGER and the bell is silent.

Suppose, now, that the HOME and ADVANCE line signals for No. 1 line are lowered for the train to go forward. The small semaphore arm is lowered to OFF and the "route indicator" pointer is deflected to No. 1 on the indicator, and remains there. These indications remain when the engine passes off

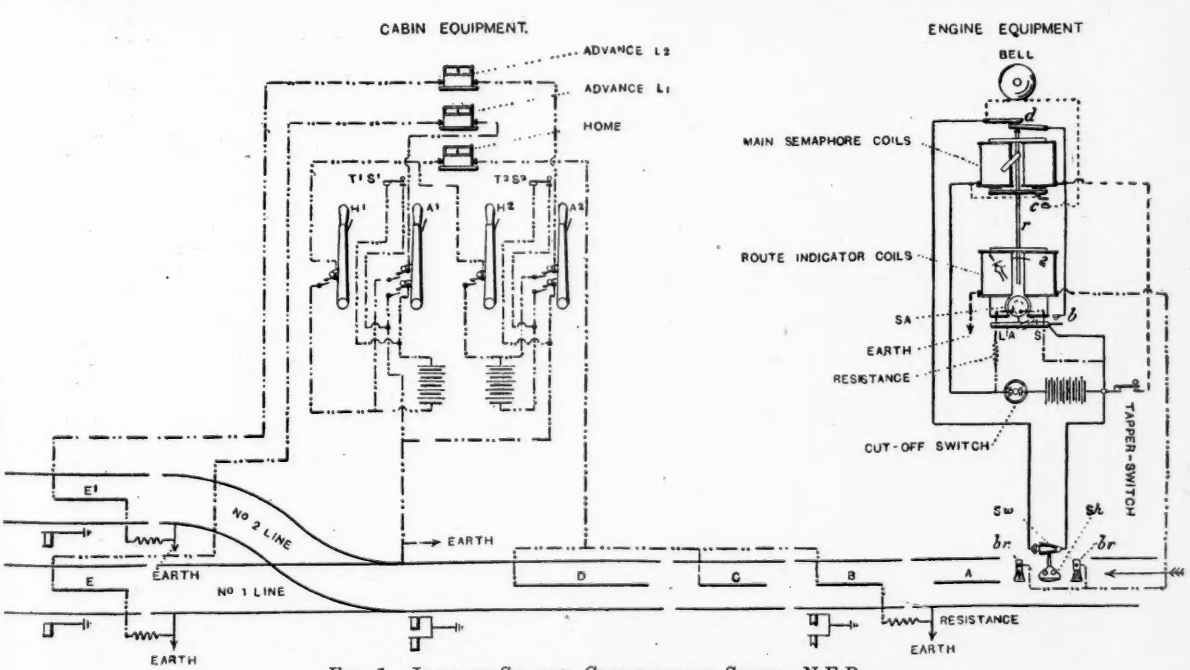

FIG. 1.—JUNCTION SIGNALS, CLOSED-CIRCUIT SYSTEM, N.E.R.

bar D, whilst passing over bar E, and until it arrives at the bar A of the next signalling point.

Suppose that the signalman had desired to draw the train forward to ADVANCE No. 1 instead of sending it right away. The engine is standing with the brushes *br*, *br*, and the shoe, *Sh*, on bar D. The signalman lowers the HOME signal and then taps the small switch T¹ S¹ several times. This has the effect of lowering and raising the small semaphore arm on the engine and calls the driver's attention and gives him to understand that he is only being drawn forward to the ADVANCE. It is thus a cautionary signal entirely distinct from the OFF signal just described. The small semaphore remains at DANGER, and when the engine moves off the bar D, the bell recom-

mences to ring. These indications continue until the engine comes to a stand on bar E.

Suppose, now, it is desired to dispatch the engine standing at No. 1 ADVANCE *line* signal. The small semaphore arm is at DANGER and the bell is silent. The signalman lowers the ADVANCE signal No. 1 by the lever A^1 in the cabin, and the small semaphore arm on the engine is immediately lowered to OFF, and the "route indicator" pointer deflected to 1 on the dial of the indicator. As described before, these indications remain until the engine arrives at the bar A of the next signalling section.

Assume, now, that the HOME and ADVANCE signals for No. 1 line have been lowered before the engine arrives at bar A. On passing over A, the small semaphore arm on the engine rises to the DANGER position, the "route indicator" pointer takes up the central position and the bell begins to ring, and these indications continue until the engine arrives at bar B. Whilst passing over B, the small semaphore arm is lowered to OFF, the "route indicator" pointer is deflected to No. 1 on the dial of the indicator, and the bell then ceases to ring. These indications are continued whilst the engine is passing over the subsequent bars C, D, E, and until it arrives at the bar A of the next signalling section. This constitutes the OFF signal.

Assume, now, that the engine, on passing over B, has obtained the OFF signal as just described, and that an emergency arises which renders it necessary to stop the engine, at the HOME signals if possible. Under ordinary circumstances, the signalman would throw his HOME and ADVANCE line signals to DANGER immediately. This action on his part, with the line signals, ensures a DANGER signal being given either at bar C, or D, or E, according to the position of the engine when the line signals are put to DANGER.

Finally, assume that the engine has passed over a bar B with the line signals at DANGER, and before it has reached bar C the signalman has lowered the line signals. The small semaphore arm is at DANGER and the "route indicator" pointer in the central position and the bell ringing. On passing over bar C, the complete OFF signal will be obtained, that is, the semaphore arm will be lowered, the "route indicator" pointer deflected to No. 1 or No. 2 on the dial of the indicator, as the case may be, and the bell stopped precisely as in the case where the OFF signal was assumed to be obtained at bar B.

It will be seen that the action of the bar A upon the engine circuits constitutes a signal warning the driver of his approach to a signalling point. The continuance of the WARNING signal constitutes a DANGER "condition" relating to the STOP signals for the signalling point which is being approached. The bar A is situated at a distance of about 150 yards from the bar B, and the WARNING signal is, therefore, of short duration only if the STOP signals are OFF. The stopping of the WARNING signal by the return of the small semaphore arm to the OFF position, the stopping of the bell, and the receipt of a "route indication," constitute the OFF signal, which can only be given when all the main line signals are OFF, and then only by the direct intention of the signalman. An indication given at the first signalling bar B can be reversed during the passage of the train from B over the subsequent bars to the ADVANCE signal. The number of points at which these reversals can be obtained is only limited by the number of intermediate bars C. The apparatus is capable of giving CALLING-ON signals as well as the OFF and ON. Currents are sent to the bars by the operation of switches connected and working with the levers operating the STOP signals, HOME and ADVANCE, and the signalman can, therefore, only give the OFF indications by intention.

As already indicated, the bars A, B, C, D, E, etc., act mechanically on the shoe *Sh*, to actuate the semaphore and bell, and electrically, by currents set in operation by the signalman, through the brushes *br*, *br*, to actuate the "route indicator" and indirectly the semaphore and bell. The opening of the switch, *Sw*, causes the armature of the main semaphore coil to be released, raising the arm to danger, and mechanically releasing the "route indicator" pointer from its deflected position. At the same time the contact *c* is made, and contact *d* broken. These alterations of the contacts, *c* and *d*, divert the current through the bell as soon as the switch *Sw* is closed by the shoe *Sh* passing off the bar A. The armature of the main semaphore coil cannot be raised by the closing of *Sw*, because the circuit is now broken at *d*. Hence the bell continues to ring, and the semaphore arm remains at DANGER until further actions take place.

The "route indicator" has two armatures; one is a shuttle-wound armature, SA, capable of turning between the poles and carrying the pointer at the front of the dial; the other is an ordinary lifting armature, LA. The shuttle-wound armature is polarized by a special circuit supplied from the engine battery, as shown. The lifting armature closes the contact *b*, which completes a circuit through the main semaphore coils. The shuttle-wound armature carries a slotted sector, S, having depressions at each end. In the slot rides a freely pivoted rod which, when the sector follows the deflection of the armature, drops into one or other of the depressions and locks the armature, pointer, etc., in the deflected position. The sector and armature is mechanically released by the dropping of the armature of the main semaphore coils, through the rod *r*.

When the engine passes on to the bar B—the small semaphore arm being at DANGER, the bell ringing, and the "route indicator" pointer in the central position—when the STOP signals are off for, say, No. 1 line, a current passes from B, by *br* and *br*, through the "route indicator" coils to the engine frame and earth. The following actions take place in the indicators:—

1. The "route indicator" pointer is deflected to No. 1 on the indicator dial, and locked.

2. The lifting armature is raised for the time the current is passing through the "route indicator" coils and closes the contact *b*.

3. The closing of *b* sends a current through the main semaphore coils, which raises the armature and breaks the contact *c* and also makes the contact *d*.

4. The breaking of contact *c* stops the bell. The making of contact *d* provides another path for a current through the main semaphore coils than that by *b*, which is broken as soon as the brushes *br*, *br* have passed off the bar B. Hence the semaphore indication is restored to what it was before the engine passed over bar A.

In passing over subsequent *energised* bars, the action of the switch *Sw* is neutralised by the closing of the contact *b*, and no change takes place in the indication. Should the engine pass over an unenergised bar after passing over B, it is obvious that the neutralising of the effect of the mechanical opening of the switch *Sw*, by the shoe *Sh*, would not take place, and indications similar to those obtained at bar A would be received. This is the basis of the emergency DANGER signal previously referred to, the de-energising of the bars being effected by putting one or both STOP signals to DANGER.

The line equipment by which bars are energised when required is simple. Movement of the signal levers in the ordinary operation of the signals to the OFF position closes switches connecting the batteries in the cabin with the line wires. Of the latter there are three; one goes to the DISTANT signal, and is connected to the bars B, C, D. One of the others goes to the ADVANCE signal for No. 1 line, and the other to the ADVANCE for No. 2 line. In each case the line wire is connected to the bar. Each of the line wires is provided with an indicator in the cabin, by which the signalman can see whether the bar is energised when he expects it is so. A small deflection only is given for this, the current being limited by the resistances connected to the bars B, E, and E^1. This resistance in no way interferes with the giving of the indications on the engine. A much greater deflection is obtained on the cabin indicators at the moment the brushes *br*, *br* of an engine are on an energised bar, and this, if looked out for, is to some extent an assurance that the apparatus is in order, and that the requisite indications are being duly given.

The cabin circuits are easily followed. H^1 and A^1 are the levers for the HOME and ADVANCE line signals for No. 1 line, and H^2 and A^2 are similar levers for No. 2 line. The circuit set up by the operation of the HOME signal lever is not complete until the corresponding ADVANCE has been operated. On the other hand the operation of either ADVANCE is sufficient to give an indication at the ADVANCE bar. Hence an OFF indication cannot be given at the bars B, C or D, unless *both* STOP signals are OFF—which corresponds to the arrangements necessary to lower a DISTANT line signal under ordinary interlocking—but such an OFF signal can be given at the ADVANCE without in any way interfering with the necessity for giving DANGER signals at the rear. The small tapper switches, T^1 S^1, and T^2 S^2, enable the "calling-on" signal previously mentioned to be given. Their normal position is open, as shown; when closed they simply intermittently take the place of the switch closed by the ADVANCE lever when the OFF signal is being given. As will be readily seen by the diagram, fig. 1, the direction of the currents to the line wire for B, C, D is different when H^2 and A^2 are operated, to what it is when H^1 and A^1 are operated, and the reversal of the "route indication" numbers follows.

The track bars are of steel, of T section, mounted on wood blocks and porcelain insulators

A consideration of the description of the apparatus will show how fully the system meets the conditions found to be necessary. It is adaptable in many other ways than those mentioned. The design of the apparatus is such as to give the fullest possible indication of failure of the equipment. The normal operating position of the semaphore arm is maintained by a continuous current, and interruption of which places the semaphore arm to DANGER, and inability to restore the arm to the normal running position is proof of such failure.

The arrangements by which the WARNING and DANGER signals are given by the mechanical raising of the shoe, obviate the necessity for relying upon the making of electrical contact with the bars of the track for giving these signals, and any failure to make such contact has only the result of causing OFF signals to be missed, and so does not in any way result in dangerous action. The apparatus is self-testing during the whole time it is in operation.

(To be continued.)

Patents and Alien Enemies.—The application of Mr. J. H Mayer, 12, Lime Street, E.C., for a licence under Patent No. 7617/10 of Podesna, for an electric igniter for explosion motors, has been granted by the Board of Trade.

LEGAL.

THE PRIZE COURT.

(Claim by Babcock & Wilcox, Ltd., allowed.)

PRESIDING over the Prize Court in the Admiralty Division, Sir Samuel Evans decided a question of the right to certain property forming part of an electrical installation, in favour of Messrs. Babcock & Wilcox, engineers and boiler makers, Glasgow. The Crown had applied for the condemnation of part of the cargo of the British steamship *Huanchaco*, consisting of boilers, bricks and other material to be used in connection with an electrical works at Valparaiso, Chile. The goods were seized at Liverpool as enemy property, the contention of the Crown being that the proprietary in the goods was in the Deutsch-Uberseeische Electricitäts Gesellschaft. The goods, it appeared, were shipped by Messrs. Babcock and Wilcox under a contract with the German company, and were intended for a company known as the Chilean Electric Tramway and Light Co., Ltd., which is registered in Great Britain. On behalf of the claimants it was contended that the German company were merely acting as advisers and buying agents on behalf of the Chilean company, in which the German company had a large financial interest, and that the proprietary in the goods never passed to the German company. It was further contended that Messrs. Babcock & Wilcox had never parted with the proprietary in the goods, and that the only persons who would lose if the cargo were condemned were the eminent firm of Scottish engineers.

The PRESIDENT, giving judgment, said that in this case he had come to a definite conclusion upon the matters that he had to decide. The question was whether or not 324 packages containing certain boilers and plant and a large number of loose bricks were enemy property. He had come to the conclusion that the German company were independent contractors, and that there was no privity of contract between Babcock & Wilcox and the Chilean company. But whether that was so or not he did not think mattered. The contract, he thought, was between Babcock & Wilcox and the German company, and the question was whether the proprietary in the goods had passed from the former to the latter. The goods were put on board at Glasgow and the ship proceeded to Liverpool, where they were seized on August 27th. The contract under which the goods were shipped was dated January 7th, 1914. The German company had also some time in 1913 entered into a contract with the claimants for the erection of four boilers in connection with electrical works at Valparaiso. In 1914 it was intended to extend those works, and the contract of January 7th, 1914, was the contract for that extension. Some of the terms of the earlier contract were not again repeated in the later contract, but they were referred to and incorporated in it. According to the contract of January 7th, 1914, what Babcock & Wilcox had to do was to supply a complete boiler installation and accessories for the extension of the works which had already been carried out in 1913. The description of the work was under four heads, and the amount to be paid was distributed between the four items, the total amounting to £7,473. This sum was to be paid by instalments, the last instalment at the expiration of one year's guarantee. The installation was to be erected under the supervision of a man sent out by the claimants, and a certain time was to elapse before the works were taken over. It was not till one year after that that the final instalment was to be paid. The cargo in question comprised only a part of the plant and did not complete the material necessary for the erection of the works. Unquestionably the goods seized were materials which would have been used in erecting the works, but what he had to decide was whether the proprietary in these disjointed pieces had already passed, or whether the passing of the proprietary depended upon something that was to be done at a later stage. The contract between the parties was not for the particular articles in fact seized. The contract was for the installation into which works these materials were to be put. In his opinion there was no passing of these disjointed pieces of goods. They were not sold as such. No separate price was fixed for them. They were only part and parcel of the whole quantity which had to be supplied. The authorities made it perfectly clear that these goods could not be treated as separate goods in respect of which there was a complete contract and a passing of property. Here there was no contract for the separate sale of the goods in question at all, and he held that at the time of seizure the proprietary had not passed. He therefore ordered that the goods be released to the claimants.

WORKMEN'S COMPENSATION.

AT the Salford County Court, last week, Charles Atherton made an application under the Workmen's Compensation Act, the respondents being Messrs. Eckstein, Heap & Co., Ltd., manufacturing electrical engineers.

MR. SANDBACH stated that the applicant had been employed by respondents at a weekly wage of 24s. While grinding an iron clam on an emery wheel some of the metal flew off and struck him in the eye, and an operation had to be performed. He attended at the hospital from September 2nd to October 29th last year, and during that time he was paid half-wages, while the respondents also gave him an extra allowance of 5s. per week, as he had a wife and family. On October 29th he returned to his work, but was put on a different job, and was a kind of odd man. His eyes were painful, and he could not see to do his work properly. On December 3rd he was given a week's notice. The man had since tried to get work at several places.

ATHERTON, in evidence, bore out the opening statement, and added that he did succeed in getting a situation at one place, but was discharged because he could not see to do his work.

Cross-examined: He denied that when he returned to Eckstein's he was discontented and careless, and declared that he did not refuse to do certain work on December 3rd, which led to his appearance at the office of the works manager. He stated that it was not in consequence of his refusal to do certain work that he was discharged.

DR. SHAND, of Regent Road, Salford, stated that he examined the applicant on January 6th. The man's eye, he said, was inflamed, and it appeared to cause him considerable pain. He could not follow his work except under great difficulties.

Cross-examined: Dr. Shand said he was not an eye specialist.

MR. MCCLEARY, for the respondents, said this was one of those cases where a man would be better off without the Workmen's Compensation Act. He was employed by a most excellent firm, suffered a small accident, and was incapacitated for a short time, and it was fair to assume that if it had not been for the Act the man would have been looked after and would have returned to his work a contented man, and not a discontented man going about spreading discontent among the other workmen and saying the firm could not discharge him. His conduct culminated on December 3rd in his refusal to obey orders.

MR. FRANK PANTER, works manager, spoke to the applicant's discontented attitude when he returned to work, and stated that he was put back on his old job, and never complained that he was not able to do the work.

DR. WHARTON said that he had examined the man, and, in his opinion, there was nothing to prevent him doing his work as formerly.

On JUDGE GURNEY'S suggestion, the man was examined by both doctors in an adjoining room, and on their return to Court, Dr. Wharton said there was no inflammation, and Dr. Shand said the inflammation had subsided somewhat, but was still present.

JUDGE GURNEY said the doctors had set him a nut to crack, and the best thing he could do, in the absence of a medical referee, was to say that the man was perfectly able to do his work. The award, therefore, would be for the respondents.

IRISH JUDGMENT SET ASIDE.

THE King's Bench Division, Dublin, has set aside a judgment against Mrs. Morrow, 3, Upper Leeson Street, for £29 6s. 4d. in an action brought by Mr. J. C. Meldon, electrical engineer, against that lady and her husband, Mr. R. Morrow, for a supply of electrical fittings, the ground stated being that the judgment was marked by surprise and through a mistake on the part of defendant. Mr. Bartley, in resisting the application, said the fittings had been sent to Mrs. Morrow.

TRAMWAY ACCIDENT CLAIM.

IN the Glasgow Court of Session, before Lord Ormidale, the record was closed in an action by Janet Henderson and Annie Henderson against the Musselburgh and District Electric Light and Traction Co., Ltd., for £1,000 and £750 respectively for the death of their father, John Henderson, 65, farm labourer, by the alleged fault of the defenders. On March 17th, 1914, he was leading a horse and cart at a walking pace out of the gate at Fowler's Brewery, Prestonpans, and across the car lines, when a tramcar ran into the cart, with the result that the car swung the cart and horse round to the side. The horse took fright, and the deceased was dragged round with them. He suffered from shock, and died the following morning. The defenders deny liability. Issues for trial were ordered.—*Glasgow Daily Herald.*

P.M.G. *v.* OXFORD ELECTRIC TRAMWAYS CO., LTD.

AT the Oxford County Court last week, the Postmaster-General sued the defendants for £6 damage to a telegraph pole. Mr. W. N. Raywood, who appeared for the Postmaster-General, said that the facts had been agreed. A motor-bus ran into a telegraph pole, the property of the Postmaster-General. The claim was made under Sec. 8 of the Telegraph Act, 1878, which enabled the Postmaster-General to recover damage done to the telegraph line by any undertakers, bodies or people. Mr. Raywood asked for leave to appeal, and his Honour granted the application.—*Oxford Chronicle.*

Norwegian Nitrogen.—The Société Norvegienne de l'Azote reports gross profits of £468,000 for 1913-14, as compared with £442,000 in 1912-13, and net profits of £316,000 and £287,000 in the two years respectively. It had been proposed to pay dividends of 8 per cent. on the preference capital and 6 per cent. on the ordinary shares, but these recommendations are not to be carried into effect. The company had concluded a loan with the Société des Annuités, of which two-thirds had been completed on the outbreak of the war. At present the work of extending the plant at Rjukan is at a standstill, owing particularly to the impossibility of securing the delivery of machinery on order, in consequence of the war.

THE HARDENING OF METALS.

THE first autumn meeting of the FARADAY SOCIETY was held on November 23rd, and took the form of a general discussion on the important subject of the HARDENING OF METALS. Sir ROBERT HADFIELD, the President of the Society, was in the chair, and the meeting, which was largely attended, included some of the best known workers in this branch of metallurgy.

There are three fundamental ways in which a metal or an alloy can be hardened:—

1. By cold working.
2. By chilling; usually suddenly from a high temperature, but sometimes by moderately slow cooling. In one instance referred to by Professor Howe, in a valuable communication which he sent from New York, cautious *reheating* is required for hardening, in the case of Maurer's austenitic manganese steel.
3. By the mere admixture of different kinds of molecules.

In the case of pure metals it is obvious that hardening must be caused by some change of state, and the question resolves itself into what is the nature of the change of state. Pure metals, as normally cooled from the molten condition, are crystalline in structure, and the change of state that hardens them must be either a re-arrangement of the crystals or a change of crystalline form, or a change from a crystalline to an amorphous form. Dr. Beilby has within the last few years brought forward a considerable body of experimental evidence which goes to prove that when pure metals are cold worked, and thus hardened, the surfaces of the crystal grains are flowed into a smooth, hard, *amorphous* vitreous layer or skin, and it is this amorphous skin so formed between the crystal grains which is the cause of the hardness brought about by cold working. The question arises as to whether, accepting the theory of the amorphous state, hardening by chilling or the hardening of alloys can be made to fall into line with this explanation of hardening by cold working. Dr. Beilby claims that there is no essential difference between the two processes, the contraction strains due to chilling supplying the mechanical work necessary to convert the crystalline into the amorphous state. The theory has been applied to the general case of hardening by quenching by Professor Edwards and Professor Carpenter, and to the particular case of steel by Mr. J. C. W. Humfrey. The former maintain that the hardness produced by quenching is brought about by crystal twinning, and possibly direct slipping, and the resulting formation of amorphous layers. Mr. Humfrey's theory of hardened steel is an adaptation of the amorphous theory to fit in with the old allotropic theory (somewhat discredited at the Faraday discussion), which considers hardening to be due to the existence above a certain critical temperature of an adamantine γ form of iron which sudden cooling prevents from slipping back into the normal form that is stable at low temperatures.

The amorphous theory was criticised by the President, Professor Howe, Dr. Desch, and Mr. A. McCance. The main ground of Sir Robert Hadfield's objection appeared to be his unwillingness to concede that the extraordinary hardness of steel was of the same character as hardness caused by cold working, and in this he was supported by Professor Turner. It was improbable, said Sir Robert, that the glass-hard surface of a projectile weighing a ton, which would cut through 15 inches of steel without being fractured, could be in a state of strain. The hardness must be brought about by chemical change, and the fact is the carbon and its condition must be the principal factor as a cause of the extreme hardness of steel, and it has been too much overlooked in the theories that have been put forward. In this Dr. J. E. Stead concurred. In his opinion the different behaviour of hardened and annealed steel when treated with chemical reagents proved that there was a difference in their chemical constitution.

Professor Howe considered that the amorphous theory would explain all those cases of hardening where there was a martensitic structure in the hardened steel. There was, however, a non-martensitising way of hardening, namely, by holding manganiferous austenite (Hadfield's manganese steel) slightly below the transformation range (*e.g.*, at 550° C.), whether the cooling thence be fast or slow, and this could not be explained by the amorphous theory, because at such high temperatures amorphous iron should be able to recrystallise.

Mr. McCance objected to the amorphous theory on the ground, among others, that strained α iron and strained γ iron were dissimilar in magnetic properties, whereas if straining produced the amorphous variety the effect in both cases should be the same. Indeed γ iron cannot be made ferro-magnetic by any treatment such as permanent deformation.

The result of the whole discussion left the impression expressed by Dr. Stead, namely, that interesting and important as are the several theories of hardening now current, we have not as yet sufficient data on which to base dogmatic conclusions. What may be called the Sheffield School has little doubt that on the carbon condition mainly depends the extreme hardness of steel, and Sir Robert Hadfield himself feels so strongly on the matter that he has offered a Research Prize of £200 in order to stimulate the study of the carbides of iron and of iron alloys generally.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

103. "Dynamo-electric machines for transforming alternating current into continuous current, or *vice versa*. J. L. LA COUR. January 4th. (Convention date, January 2nd, 1914. Sweden.)

112. "Galvanic batteries." C. B. BURDON. January 4th. (Siemens & Halske Akt. Ges., Germany.)

114. "Electric automatic protector." A. W. H. NASH. January 4th.

121. "Means for obtaining a high starting-torque on a continuous-current motor with a relatively small starting-current." A. J. LEIGH & H. J. OSBORN. January 4th. (Complete.)

123. "Electrical adapters." L. ROSENTHAL. January 4th.

129. "Magneto-electric machines." R. B. NORTH & A. M. ALLEN. January 4th.

130. "Magneto-electric machines." R. B. NORTH & A. M. ALLEN. January 4th.

131. "Electric fusible cut-outs." H. P. LIVERSIDGE & PENNSYLVANIA APPLIANCE Co. January 4th. (Complete.)

154. "Electric heating-pad." G. LANDER. January 5th. (Luis Zanaboni, Argentina.)

180. "Electric starting devices for motor-driven vehicles." MASCHINENFABRIK OERLIKON. January 5th. (Convention date, January 29th, 1914. Switzerland.) (Complete.)

188. "Incandescent electric-lamp holders." C. PRESSLAND. January 5th.

190. "Combined mechanical and electrical devices." M. WUILLOT. January 5th. (Convention date, January 24th, 1914. Belgium.) (Complete.)

247. "Dynamo magneto-electric generating machines, particularly applicable for lighting, charging, and ignition in connection with internal-combustion engines of motor-cars, launches, aeroplanes and the like." C. H. MELSOME-SMITH. January 7th.

264. "X-ray apparatus." H. W. COX & Co., LTD., & H. E. DONNITHORNE. January 7th.

270. "Excess wattmeters." A. W. BURKE. January 7th. (Convention date, January 21st, 1914, United States.) (Complete.)

275. "Electric wave amplifying apparatus." WESTERN ELECTRIC Co., LTD. January 7th. (Western Electric Co., United States.) (Complete.)

282. "Electric heaters for culinary and other purposes." BENHAM & SONS, LTD., & C. R. ALLENSBY. January 7th.

303. "Manufacture of composition for the manufacture of artificial leather, floorcloth, paper, insulating material, boards, paint, and other purposes." W. P. THOMPSON. January 8th. (Herman Arledter, Austria.)

324. "Electrical transmitter microphones." B. A. PILKINGTON. January 8th.

350. "Electro-magnetic levitating projector and projectiles therefor." E. P. BACHELET. January 8th.

367. "Electrical switches." A. P. LUNDBERG, G. C. LUNDBERG, P. A. LUNDBERG & G. PEGG. January 9th.

378. "Electric cable joint boxes and the like." A. H. RAILING & C. C. GARRARD. January 9th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford, price, post free, 9d. (in stamps).

1913.

25,062. SIGNALLING APPARATUS. E. C. R. Marks. (Mead Electric Signal Co.). November 3rd.

26,364. MAGNETIC SEPARATORS. A. F. Jobke. November 17th.

26,834. MULTIPLE ARRANGEMENTS OF HIGH-FREQUENCY ELECTRIC CURRENT GENERATORS. P. O. Pedersen & V. Poulsen. November 21st. (December 12th, 1912.)

28,703. AUTOMATIC CONTROL SYSTEM FOR ELECTRIC RAILWAYS. B. F. Hutches. Jun. December 12th.

28,956. ELECTRIC SIGNALLING SYSTEMS. A. W. Brown & I. H. Parsons. December 16th.

29,063. REGULATORS FOR ELECTRIC TRANSFORMING APPARATUS. British Thomson-Houston Co. (General Electric Co.). December 16th.

29,346. DEVICES FOR CORRECTING THE DIFFERENCE OF PHASE IN TELEGRAPHIC RECEIVING APPARATUS. A. C. Baronio & K. L. Wood. December 19th. (Cognate application, 16,905/14.)

29,526. DEVICE MORE PARTICULARLY INTENDED FOR USE ON ELECTRIC LIGHT OR OTHER SWITCHES OR CONTROLS, FOR DISPLAYING REMINDERS, ADVERTISEMENTS, NOTICES, AND THE LIKE. E. Clarke. December 22nd.

29,562. SELF-EXCITED ELECTRIC MOTORS FOR OPERATING SLIDING WINDOWS AND THE LIKE. J. F. P. de la Riboisiere & R. le Grain. December 22nd. (December 23rd, 1912.)

29,655. MACHINES FOR GENERATING ELECTRICAL ENERGY. C. T. Mason. December 23rd.

29,713. LIQUID RESISTANCES. Akt. Ges. Brown, Boveri, et Cie. December 24th. (January 9th, 1913.)

29,776. COUPLINGS OR CONNECTIONS FOR ELECTRICAL CONDUCTORS. J. Stone & Co. and A. H. Darker. December 24th.

29,861. RETARDING OR TIME-LIMIT DEVICES. W. A. Coates & Ferranti, Ltd. December 29th.

29,902. GENERATION OF ELECTRICAL OSCILLATIONS. A. F. Sykes & Ford. December 29th.

1914.

124. DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co. & A. A. Pollock. January 2nd.

125. GLOBE HOLDERS. British Thomson-Houston Co. (General Electric Co.). January 2nd.

1,437. PROCESS FOR THE ELECTROLYTIC PRODUCTION OF MALLEABLE OR FORGEABLE IRON. E. F. K. Harbeck & B. Lan. January 19th.

1,715. MAGNET POLE-PIECES OF TELEPHONE RECEIVERS AND THE LIKE. A. Marr. January 22nd.

2,325. ELECTRICAL HEATING DEVICE. R. W. Gauntlett. January 28th.

2,495. PORTABLE ELECTRIC LAMPS. W. A. McKay and M. Claussen. January 30th. (February 11th, 1913.)

3,806. CANDLE LAMP. C. E. Green & Arctic Light Co. February 13th.

4,261. ELECTRIC CHIMING AND STRIKING GEAR. H. Wilson. February 19th.

5,776. AUTOMATIC VOLTAGE REGULATORS. British Thomson-Houston Co. (General Electric Co.). March 6th.

7,019. MEANS FOR SIGNALLING ON TRAINS. W. E. Benn. March 19th.

8,062. PROTECTIVE CASING FOR ELECTRIC CABLES. R. McGeoch. March 31st.

9,376. PRINTING TELEGRAPH SYSTEMS. Western Electric Co. (F. T. Woodward, acting for Western Electric Co.). April 15th.